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# The Chemical Age

VOL LXVII

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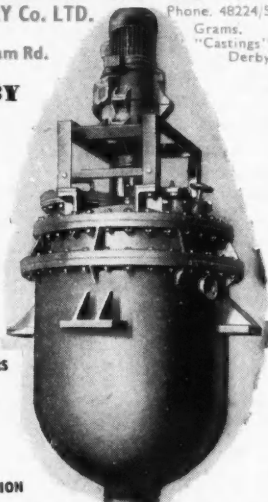
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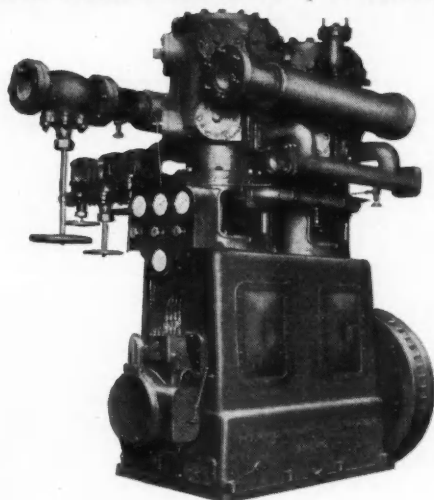


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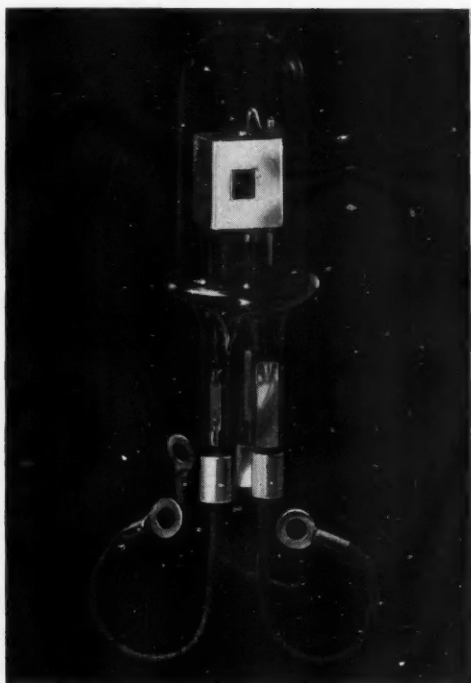


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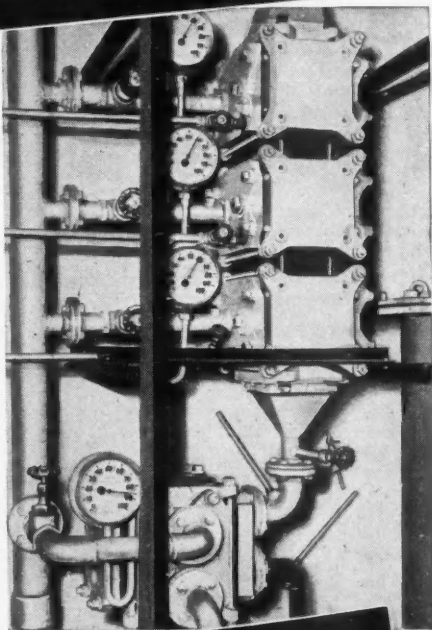
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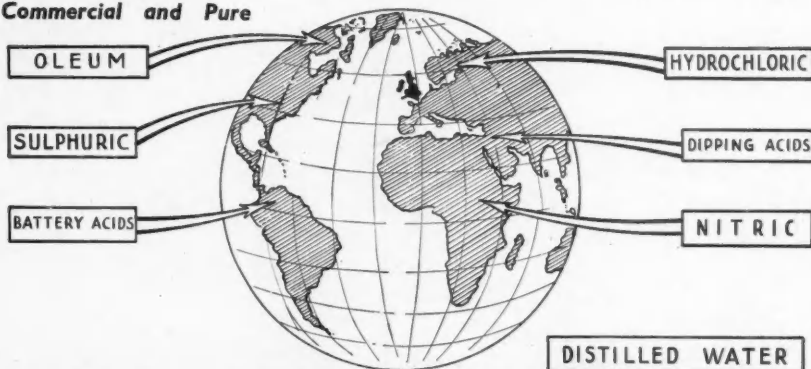
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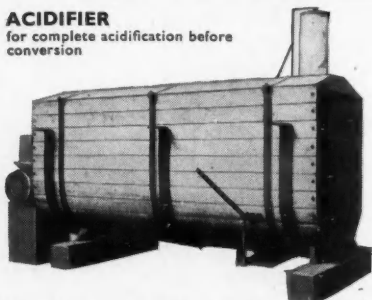
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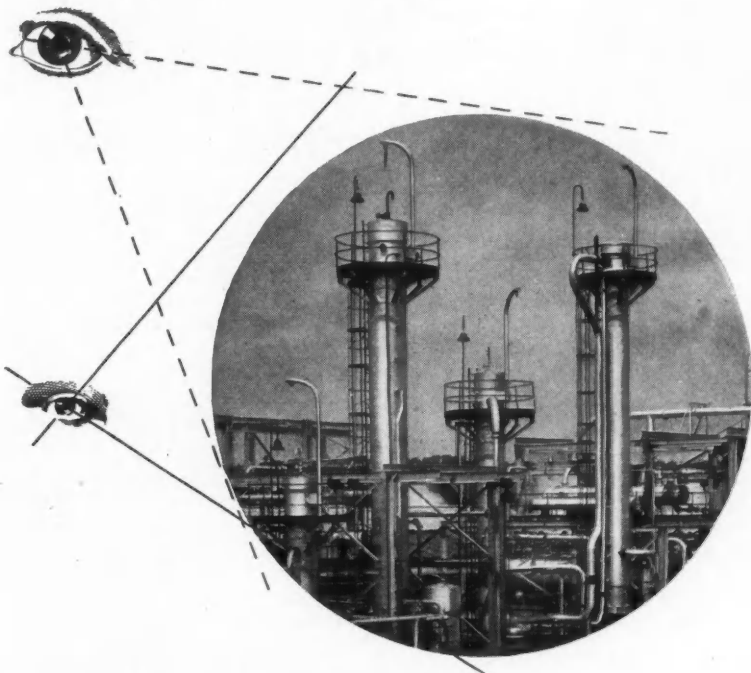
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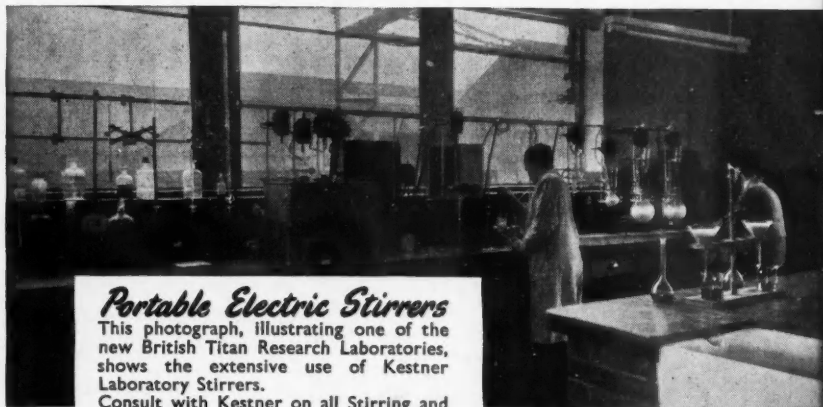
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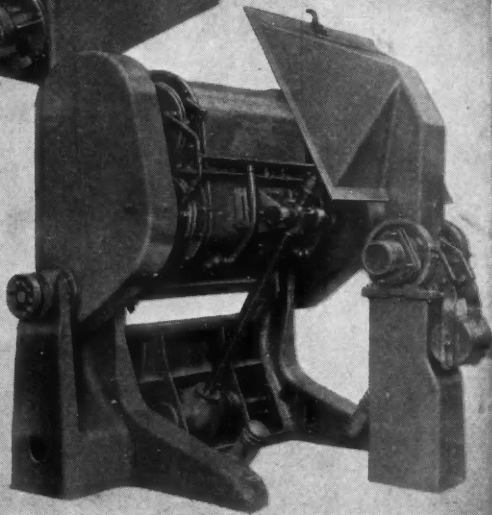
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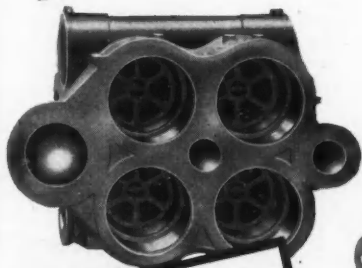


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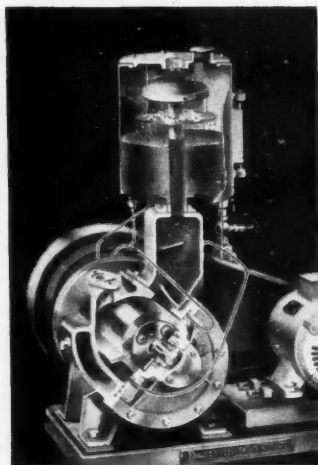
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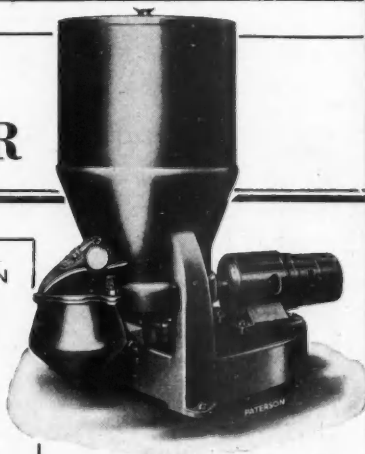
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30 August 1952

Number 1729

## A Little Goes a Long Way

THE world is used by now to the marvels wrought by trace substances, present in their environments in such small quantities that their very existence remained unknown for centuries. As science progresses, more and more of these mysterious agents become known, repointing the moral that Nature, unnecessarily wasteful in some directions, can be thrifty to the point of parsimony in others. A favourite element of hers that has recently been adding to its laurels is molybdenum.

Molybdenum itself has been known for some time. Until 1778, however, it was confused with graphite, which shared with molybdenite the ability to mark paper black—an error which has been perpetuated in its name, which derives from the Greek word for lead—*molybdena*. During World War I the invaluable properties of molybdenum when added in trace amounts to steels were first discovered, and since that time the metallurgy of the element has steadily advanced. It is not, however, in this field that startling new discoveries have been made, but in the field of agriculture.

Not so long ago the only interest molybdenum possessed for agricultural chemists was the canary-yellow precipitate formed by ammonium molybdate and phosphate solutions, which provides

a means for measuring that major plant nutrient. It was for a long time unsuspected that molybdenum could be a plant nutrient in its own right. Its actual presence in plant composition was established in 1900 by Demarcay, but Hewitt and Jones at Long Ashton, as recently as 1947, can claim to have first shown conclusively that molybdenum is in fact an essential plant nutrient. If traces of molybdenum are not present, excessive amounts of nitrate-nitrogen accumulate in the plant. Plants assimilate their nitrogen needs predominantly as nitrate, and the reduction processes of plant metabolism convert this form of nitrogen into amino-acids, proteins, and other organic complexities. These essential processes seem to be acutely dependent upon the presence of minute amounts of molybdenum.

It is not surprising that this trace element's recognition came so belatedly, more than a generation later than the recognition of iron, manganese, boron, etc., for most of the earlier agricultural work was concerned with molybdenum's toxicity. If minute amounts are essential, a little more can make fodder crops poisonous to cattle; and the hazards of the so-called teart pastures of Somerset were traced to excessive molybdenum in the herbage some years before

molybdenum's necessity to plant life was accepted. In Wyoming, too, the toxic dangers of soils naturally high in molybdenum content had given the element a stigma. Now, however, there is a steady stream of papers unravelling the complex story of molybdenum in plant nutrition. In the recent 1951 Report from Long Ashton, four of the ten papers on plant nutrition were devoted to this single element.

But it is from New Zealand that the most spectacular evidence has come. The heavy application of lime to pastures in Otago and Southland has long been effective, but although in early years good responses to lime were to be expected, the continued responses, long after the lime status of the soils had been built up, mystified soil scientists. Lime tests showed that the soils should not require lime; yet in farming practice heavy dressings still produced large increases in output. Enough by then was known about molybdenum as a trace nutrient to indicate that, unlike other trace nutrients, it was made more available in soils by liming. Excessive liming tends to create deficiencies of the other trace nutrients—molybdenum alone moves in a contrary pH direction.

With brilliant speculation the New Zealand soil scientists wondered if the persistent responses to lime were in fact attributable to the release of soil molybdenum. In 1950/51 they put their hunch to the test. Pasture plots were treated without lime and with varying dressings of lime and for each of these treatments  $2\frac{1}{2}$  ounces of sodium molybdate

per acre was also given. The results were extraordinary. For the unlimed plots the tiny dressing of molybdate increased herbage output from 10,200 lb. per acre to 15,500 lb. over a period of four months. Yield increases of the same order—50 per cent—were given when dressings of  $\frac{1}{2}$  and  $1\frac{1}{2}$  tons of lime were also made; only when as much as 3 tons of lime per acre were given did the  $2\frac{1}{2}$  ounces of molybdate have no effect. In short, this minute amount of a molybdenum compound—a mere  $2\frac{1}{2}$  ounces—was as effective in producing some  $2\frac{1}{2}$  extra tons of green fodder as  $1\frac{1}{2}$  tons of lime. Other field tests in New Zealand have provided confirmation.

It should be observed that these results have been obtained on special soils, soils in which the natural reserve of molybdenum tends to be unavailable; no one should assume that on all types of soil sodium molybdate by the ounce can take the place of lime by the ton. Nevertheless, it must be doubted whether field evidence has ever demonstrated the virtues of a trace element more dramatically; possibly Australian experiences with zinc dressings could be considered comparable, but we can think of no others. And there are large areas of New Zealand pasture likely to be responsive to molybdate dressings. At only  $2\frac{1}{2}$  ounces per acre the total tonnage of sodium molybdate needed would not be great but the potential increases in pasture output could be huge—even though New Zealand already exports more food per head of population than any other country in the world.

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## Notes & Comments

### Unwillingly to School

IN the current issue of *Discovery* (August, 1952) Dr. James, a schoolmaster, discusses the position of science teaching in our schools. Some may consider that this is a subject to which *THE CHEMICAL AGE* has already devoted sufficient space, but at the risk of repetition we believe that there cannot be too much attention drawn to this steadily decaying foundation of British science. It is a confirmation of our previous criticisms when Dr. James writes: 'It is too often overlooked that the contribution of scientific knowledge to our national life is completely dependent upon an adequate level of scientific education in the schools.' In Dr. James's view the scarcity of science masters is not at present 'obviously' critical. Today most of the advanced science teaching is in the hands of men who are forty-five or older. In short, the real crisis is to come. Today schools vary in the quality of their science teaching, some displaying the descending symptoms of the future, some still able to maintain the better standard of the past. Each year ahead there must be less old blood in circulation, but little or no new blood to take its place. A most dangerous condition of primary anaemia is being created now—and, as every doctor knows, a primary anaemia is not easily or rapidly cured if treatment is not given before the patient breaks down.

### More than One Cruse

DR. JAMES does not lay all the blame for lack of recruits upon the financial position. He suggests that the worst feature of the pay system is that differentials between the men with minimum qualifications (a school certificate and two years' training) and maximum qualifications (a first class honours degree) are scarcely significant. But salary injustices are not the only deterrent. The high prestige of research exerts a preferential attraction for many young scientists who might otherwise choose a career in teaching. Dr. James

asks whether too many young men are not being encouraged to carry on in mediocre research far too long and whether industry is not obtaining too many men of quality for research appointments that are in fact routine technical work. We might agree with his former point of criticism; but, knowing the scarcity of men who can carry out applied research and development work, we cannot share his doubts about wastage in industry. But Dr. James's fundamental criticism is true enough—the future basis of research in universities or in industry is being undermined unless an adequate proportion of good science graduates annually come forward for the schools. Can we build new floors and add extra wings to the house of science when the foundations are crumbling with unchecked dry rot?

One practical consideration raised by Dr. James concerns the year of professional training that a graduate is expected to undertake. A good science graduate should be excused from this and should be able to feel that his scholastic career is in no way handicapped as a result. Schoolmasters alone can judge the values of training courses in teaching *per se*. To outsiders, however, it seems odd that extra training should be expected or required before a graduate with a good degree can take up a career in which he must always be at a financial disadvantage.

### Russian Views on Resonance

AN INTERESTING letter on the Russian criticisms of Pauling's theory of resonance in organic molecules has recently appeared in *Chemical and Engineering News* from Professor Wheland. This letter replies to an earlier one on the same subject from Dr. G. M. Kosolapoff, and it comes to the conclusion that what the Russians have been criticising is not the resonance theory at all, but a misinterpretation of the resonance theory; their own ideas on the subject (apart from the political side to it) amounting to much the same thing

as the correct version of the theory propounded by Professor Pauling. Dr. Kosolapoff, in his letter, interpreted a resonance hybrid as being a dynamic state derived from Kekulé's concept of an oscillating bond, and brought about by the variation in interatomic distances in the molecule as a result of *thermal* motion. He further said that the Russian scientists object primarily to the view that the multiple structural formulae used to represent contributory resonating structures are *not* individual states of the molecule and should be mentally summed. However, with this implication that if the theory had envisaged the contributory resonance structures as actually existing molecules the Russians would not have objected, Professor Wheland expressly disagrees. One of the major criticisms by the Russians, he says, is that these separate structures cannot be considered as real, and for the West to treat them as the real structures of actual molecules is quite wrong. Here the Russians are perfectly justified in their criticism. Professor Wheland points out that Dr. Kosolapoff's idea of resonance as a dynamic state depending on thermal internuclear vibrations for its existence—i.e., as a special type of tautomerism—is quite untenable since the values that can be calculated for the 'resonance frequency' (here actually meaningless) are several powers of ten greater than observed frequencies of internuclear

vibrations. Moreover, the energy of a tautomeric system is merely the weighted mean of that of each of its components, while the energy of a resonance hybrid is always lower than would be expected for the most stable contributory structure.

### Topsy-Turvydom

**B**Y his clarification of a complicated situation Professor Wheland shows that the confusion on the resonance theory is not all on the Russian side. With his mistaken view of the theory Dr. Kosolapoff actually gives substance to the erroneous interpretation that the Russians have been criticising. It is a difficult theory to comprehend fully and even harder to describe, and Dr. Kosolapoff's letter makes it easy to understand how the Russian scientists have got hold of the wrong end of the stick. One other interesting comment is made by Professor Wheland in his letter when he mentions the non-destructive ideas of the Russians on resonance. After demolishing what they consider (erroneously) to be the foundation of the theory, he says, they go on to explain how the structure of a molecule like that of benzene ought *really* to be described. Interestingly enough, the 'new' conclusions to which they finally come are practically indistinguishable (except for terminology) from those which, 20 years ago, were reached by numerous Western scientists from a *correct* application of the theory.

### Zinc Restrictions Removed

OWING to improvement in supplies, administrative arrangements which restrict the use of zinc for galvanising iron and steel sheet, wire, wire products, and tubes were removed from 15 August, it was announced by the Ministry of Supply and the Board of Trade.

Licences will still be required to obtain virgin zinc, but the allocation system will be discontinued.

The Copper and Zinc (Prohibited Uses) Orders which prohibit the use of zinc, copper and alloys such as brass in a large number of articles will be amended so that the control in future will apply only to copper and copper-based alloys. Amendments will come into effect shortly.

### Paraffin Wax & Scale

THE following reduction in prices of paraffin wax and scale ex store/works with effect from 5 August are announced by Shell-Mex and B.P., Ltd.:—

Grade °F. Melting Pt.	PRICE PER TON			
	Minimum 1 ton lots		Smaller Quantities	
	£ s. d.		£ s. d.	
100/105	67 15 0		68 10 0	
106/110	67 15 0		68 10 0	
110/115	66 10 0		67 5 0	
115/117	67 2 6		67 17 6	
117/120	67 2 6		67 17 6	
120/125	67 15 0		68 10 0	
125/130	70 10 0		71 5 0	
130/135	71 10 0		72 5 0	
135/140	72 15 0		73 10 0	
140/145	75 0 0		75 15 0	
145/150	80 0 0		80 15 0	
150/155	90 0 0		90 15 0	
Scale	63 14 0		64 9 0	



# Chemical Engineering in the U.S.A.

## Report of the OEEC Technical Mission

THE action of the chemical engineer is decisive when a process has to be transposed from the laboratory to the industrial state, and a large part of the success of the great American achievement in industrial chemistry is due to the chemical engineer.

These points are emphasised in the conclusions of Technical Assistance Mission No. 23, a group of European experts, who toured the U.S.A. in September and October, 1950, on a programme drawn up by the Chemical Products Committee of the Organisation for European Economic Co-operation.

Particular interest attaches to the report, entitled 'Chemical Apparatus in the U.S.A.\*' as the mission was the first and so far the only one of the Productivity Teams or OEEC missions to visit the U.S.A., devoted exclusively to chemical engineering.

Main points covered were a general study of the methods employed in the design and construction of chemical installations and a special sample study of the methods employed in the development and utilisation of control instruments, of the special maintenance methods employed in the chemical industry and of the resistance of the various materials of construction to chemical agents.

From this broad basis, further special aspects were studied of: chemical engineering; functions of a 'job' engineer (who in the U.S.A. is responsible for the complete installation of workshops and plants based on designs prepared by the design engineer with his collaboration); pilot plants, etc.

### New Developments

Information is given on a number of developments which have taken place in the U.S.A. in the last 10 to 20 years.

During its tour the mission, in addition to the National Bureau of Standards at Washington, visited 19 American firms. Of these six were chemical equipment manufacturers, two constructors of automatic control and measuring devices, and seven chemical engineering contractors. The remainder of the

visits included a steel producer, an aluminium manufacturer, a firm specialising in transportation, and an oil refinery.

The mission was composed of 11 members under the chairmanship of Dr. A. H. M. Andreasen, professor of chemical technology at the Royal Danish Technical University, Copenhagen. The United Kingdom was represented by Mr. A. J. Young, head of the Central Instruments Section of Imperial Chemical Industries, Ltd., and Norway by Dr. S. G. Terjesen, professor of chemical engineering, at the Norwegian Institute of Technology, who is also the editor of the report. Other members were all high chemical executives representing Austria, Belgium, France, Greece, Italy, the Netherlands (two delegates), and Sweden.

### Functions Outlined

In the opening chapter, the report quotes the definition of chemical engineering recently adopted by the American Institute of Chemical Engineers, emphasises the need for the chemical engineer and outlines his most important functions as research and development; process design; equipment design; plant operation; laboratory testing; technical service and sales.

Considerable importance is attached to education in chemical engineering, the change in treatment of the subject is shown and a list of subjects given to illustrate a modern chemical engineering curriculum in the U.S.A.

Rapid growth and youth of the chemical engineering profession in the U.S.A. is exemplified by the American Institute of Chemical Engineers, membership of which totals some 10,500 fully qualified engineers, of whom about 50 per cent are under 30 years of age.

In a table prepared by the National Roster of Scientific and Specialised Personnel it is shown that in the distribution of chemical engineers by occupational functions the predominance (30.6 per cent) is devoted to research and development.

Contrasting the rapid development of chemical engineering in America with European conditions, the report emphasises that Europe must learn that established traditions

\* 'Chemical Apparatus in the U.S.A.' published by the Organisation for European Economic Co-operation, 2 Rue Andre Pascal, Paris, 16e, and obtainable from H.M.S.O., 20s. postage extra. The report is also published in French (1,000 francs).

in the chemical industry cannot be allowed to hamper progress, and that substantial investments in chemical engineering education, research and development pay high dividends.

Referring to the objection sometimes raised that in the smaller countries of Europe, most industries are too small to afford a new specialist such as the chemical engineer, it is stressed that of all engineers the chemical engineer is the most versatile. If a small chemical firm can only afford a single engineer, then a chemical engineer should be chosen.

Recommendations made by the mission are that additional university chairs in chemical engineering should be established in Europe and that scholarships for post-graduate research be provided on a more liberal scale, particularly by industry.

#### Six Large Firms in U.S.A.

The second chapter of the report deals with the chemical engineering and construction firms which, in most cases, are equipped to handle the development of a new process from the laboratory stage to the final commercial plant. In the U.S.A. there are about six large firms of this type and 25-30 smaller ones.

Development of these chemical engineering contracting firms in America has been mainly due to the growth of the petroleum refining industry. While their activities have recently been extended to the general chemical industries, 80-90 per cent are still estimated to be for the petroleum industry.

The reason for this is that the projects in this field are usually too large to be handled by the refiner's own engineering staff. It is not considered desirable to expand the staff by additional experts, if available, and then dismiss them when the new project is completed.

In the field of oil refining there is a relatively free exchange of information, and a successful new process may be developed by a number of refineries.

With chemical manufacture the situation is different. Processes and improvements are often more jealously guarded, while the more gradual expansion enables the chemical manufacturer to keep his engineering staff more fully occupied.

Activities of contractor firms have therefore in the past been largely limited to such projects as boiler plants, fractionating equip-

ment, Dowtherm heating systems, ammonia absorbers, and so on, and to processes like solvent extraction and refining of animal and vegetable oils, fatty acid distillation, nitrogen fixation and the manufacture of phthalic anhydride. These processes resembles those of the oil industry in that they are used by many firms and that experience gained from one installation can be utilised in the design of subsequent plant.

In Europe, the report points out, there are a number of firms operating as chemical engineering contractors on a considerable scale in the actual chemical field. Few of these, however, are capable of undertaking the design and construction of oil refineries, and it would seem to be to the great advantage of the European oil industry to make the most of the accumulated experience of the U.S.A. through American contractors.

Working methods, staffing and general policy of these chemical engineering contractors are well summarised in the report, and the conclusion of the mission is that European firms would do well to consider adopting the principles of extensive pooling of patents and the publication of general chemical engineering information which has greatly aided progress of the petroleum industry in the U.S.A.

#### Internal Standardisation

Standardisation in all its aspects is considered in chapter three of the report, which shows that in the U.S.A. the larger firms in industry and the Government organisations are of sufficient size to make internal standardisation economic from their own point of view.

There seems to be little doubt that the system in each country in Europe for the production of national standards is much simpler, and that if the value of standards was appreciated to the same extent, progress in Europe would be far more rapid than under the complex U.S. system.

Advantages to be gained from a wider application of standardisation are emphasised by the mission, which recommends its increased use by the chemical industry.

Reasons for the rapid advance of the chemical industry in the U.S.A. and a general discussion of its working methods form the subject of the final chapter of the first section of the report.

The shortcoming of Europe is certainly not due to any lack of brilliant chemists or

physicists; nor is the American advance entirely due to the favourable conditions of a large home market, superior natural resources and the fact that the U.S.A. has escaped the worst effects of two major world wars.

What is considered a strong influence by the mission is the progressive attitude of the American people and their talent for developing and applying the result of research work to large-scale operation.

It is essential to realise, the report points out, that the nature of invention is changing slowly but significantly. Most of the important recent developments in the chemical industry in the U.S.A. cannot be traced back to any particular individual but result from the united efforts of many.

Efficient pilot-plant work requires the co-operation of many. Thus the process developed in the laboratory is tentatively transposed to full scale for preliminary estimate of investment and operating costs. The project is scrutinised and the decision made to build the pilot-plant.

Necessary equilibrium data are supplied by the physical chemist, while the process and equipment for the pilot-plant are designed mainly by the chemical engineer. After erection it is run by the chemical engineer, with the co-operation of the analytical and research chemists and the chemical engineer, while the commercial prospects are kept constantly under review.

#### Leave it to the Expert

Pointing out the willingness in the U.S.A. to make use of sub-contractors where costs could be saved the report sums up the difference between the American and European attitude to specialisation by saying that the importance of not doing anything that others can do better is more widely understood in the new world than in the old.

Relationship between the economics on one side and chemical engineering development and research on the other is much closer in the U.S.A. than elsewhere and more of a routine nature. The stress on economics certainly does not exclude long-term research and development, but it does mean that these projects must be subjected to frequent commercial assessment.

This attitude is also ingrained in the minds of many academic workers and teachers, particularly in the field of chemical engineering.

Referring to the exchange of information the report states that while some of the major European firms are, like American managements, anxious to make a contribution to the general pool of knowledge, the great majority still maintain an indiscriminate secrecy.

The second part of the report is divided into eight chapters, seven of which are devoted to specialised topics and the final one to a summary of the mission's conclusions.

Dealing with process instrumentation (chapter five), the main arguments for using automatic control in the chemical industry are advanced, and the mission recommends that attention should be drawn to the value of instrumentation as a means of increasing productivity, and that the chemical industry should endeavour to make its requirements clear to the makers.

#### More Fluidisation in Europe

Catalytic processes in the petroleum industry are next discussed and the conclusion reached that further application of the moving and fluidised bed techniques should be considered in Europe.

In chapter seven the report deals with methods of separating homogeneous mixtures and advocates that the chemical industry in Europe should closely follow American development, and to a greater extent adopt the improvements made for increased efficiency, particularly with regard to hyper-sorption, centrifugal extraction and extractive distillation.

Heat exchange is the subject of chapter eight, while a survey of miscellaneous equipment for the chemical industries follows.

Materials of construction for chemical equipment discussed in chapter 10 include stainless steel, aluminium, plastics, enamelled (glass lined) equipment and the construction of pressure vessels by the 'layer method'. Attention of the European chemical industry is drawn to developments in the U.S.A., particularly the welding of stainless steel with water cooling; use of layer vessels for high pressure; aluminium pressure vessels and instrument tubing; and Teflon shielded gaskets.

Finally, in dealing with the transport and storage of chemicals the mission's recommendations include: Europe should consider increasing the number of products shipped in bulk, increasing the size of wagon load;

and standardising their types; a wider application of belt conveyors and pipelines for bulk transport over considerable distances; the attention of European industrialists should be drawn to the advantages of the Horton storage vessels for liquids with high vapour pressure.

There are six appendices which deal with the itinerary of the mission; qualifications for an accredited undergraduate curriculum of chemical engineering; the detailed organisation of two chemical engineering firms; the flow and sequence of the development and commercialisation of a new process or product; and a survey, with illustrations, of some modern American instruments for measurement and control processes.

## Use of Methane in Italy

### Second Convention Held at Verona

THE second Convention on the use of methane in Italy was held at Verona, on 13 March this year, with Professor Mario Medici as president, over a large and distinguished assembly representing Government, industry, and science. A brief report of the proceedings is given in *La Ricerca Scientif.*, 1952, 22 (6), 1254-1257—June. Considerable progress has been made with the scheme voted at the previous Convention, namely, that of a piped gas supply in Padana Superiore, with piping 16 in. in diameter. This has now been linked with the SNAM (Soc. Nat. Methane) and Verona, and is proceeding to Vicenza and Marghera. The gas is being used in various industries and also for domestic heating. These developments formed the subject of a paper by Comm. G. Bovo, president of the Verona Chamber of Commerce, promoters of the Convention.

President Medici then reported progress with the new design of methane-fired furnace for the production of malleable cast iron, which is said to effect large economies, and of another 'methanised' furnace for making slaked lime; also of a third, of rotary type, for cement manufacture. These and others constitute a vast extension of methane utilisation in many branches of industry—metallurgical, glass and ceramics, and food-stuffs. The so-called Diesel-Dual motors have now reached the stage of semi-industrial tests, but no details of results were given. Another important works in Italy is

that of the thermo-electric super power station at Tavazzano, said to include the first expansion turbine run on natural gas in Europe.

The proceedings of the Convention were then divided into four sections: (a) distribution of methane in medium and small centres; (b) measuring and pressure reducing apparatus, gas burners, etc.; (c) electrical power stand-by and emergency units run on natural gas; (d) use of methane in agriculture. Engineer Franco Salimbeni gave a general account of his travels in the U.S.A., and of the progress in natural gas utilisation in that country. Virgilio Dazzo, director of the Azienda Metanodotti Padane (AMP) and of the Soc. Ital. Metano (SIM) described gas distribution in small and medium size systems, as exemplified in the Veneta district. Engineer Pietro Bonetti, of the Azienda Servizi Municipal. of Verona, related progress in mains supply in that city, including the cracking plant. Others were opposed to the idea of cracking for gas distribution.

In the second section Professor Igino Tessari dealt mainly with metrological and pressure-reducing instruments, adopting the standard and unified system of nomenclature and symbols agreed by the Italian Thermo-technical committee. Other papers on measuring and related subjects followed, by engineers Tieghi, Pigorini and others; also on burners and furnaces by Engineer Libero Donati, of the AGIP-GAS, these including a new type of burner he had designed for brick kilns specially for use in a Hoffman furnace, as, for instance, in the Cortemaggiore-Piacenza.

The third section was opened by Mr. Feilden, of Ruston & Hornsby, Ltd., who described the gas turbine constructed by that firm, and exhibited an actual model that could be used in a mobile plant.

The fourth section on agricultural uses of methane comprised two papers: one by Professor Roberti who included some account of methane for ammonia and nitrogenous fertiliser production; and the other by Engineer E. Pietrabissa on methane motors for tractors and suchlike.

### Change of Address

The British Chemical and Dyestuffs Traders' Association announces that as from 26 August, 1952, its address will be: 12 York Buildings, Adelphi, London, W.C.2 (Telephone WHITEhall 4963/4).

# Carbon Refractory Development

## Tunnel Kiln Lighted at Loxley Works

THE lighting-up recently of the new tunnel kiln at the Loxley Works of Carblox, Ltd., represented the culminating point of an expansion scheme that has been taking place over the last two years.

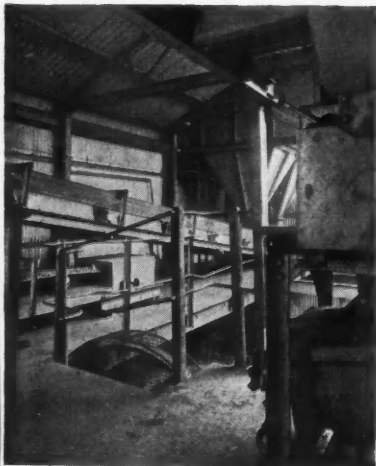
A few short years ago, two companies associated in order to study and manufacture carbon refractories, at the request of the iron making industry. These two companies were Thomas Marshall & Co. (Loxley), Ltd., of Loxley, Sheffield, and The Morgan Crucible Co., Ltd., of London, and the company so formed was Carblox, Ltd., of Storrs Bridge, Sheffield. Thomas Marshall's brought with them over one hundred years' experience in the manufacture of refractories, and The Morgan Crucible Co., Ltd., a similar wealth of knowledge in the handling and manufacture of carbon. Together they investigated, developed and produced Carblox refractories.

Within a very short space of time, so successful was this product, that it became apparent that the demand for this type of refractory was far outstripping the production capacity of the original pilot plant. With improved manufacturing methods and technique it was possible to increase output. Thus, within three years of commencing full-

scale manufacture Carblox had more than doubled their output and have continued to increase their production every year. Even these efforts did not solve the ever-growing problem of supply and demand, and it was obvious that new plant would have to be erected.

The board of Carblox, Ltd., put in hand a programme of expansion involving the erection of new buildings and plant ultimately to quadruple the 1950 output. The starting-up of the tunnel kiln, already mentioned, represented the end of this second phase of Carblox history—a phase which it is anticipated will meet all the demands of the iron and chemical industries for many years to come.

The new tunnel kiln is 133 ft. long, 18 ft. wide, and 12 ft. high. It has a capacity of 23 cars which are 5 ft. 6 in. long, 5 ft. 3 in. wide. The cars are fitted with built-on containers which each hold approximately



*Above: One of the bank of presses making Carblox standard shapes*

*Left: Hoppers containing raw materials, and conveyor to mixing pans*

3,500 lb. of Carblox Carbon products and packing. The car schedule is one car per two hours, giving a total output of 100/140 tons per week, according to the type of material produced.

The kiln is of a special design and is capable of dealing with the volatiles given off from the green ware without resorting to any extra kilning space. This design enables a short operating cycle to be employed and appreciably steps up production. Automatic temperature control ensures suitable conditions throughout, maintained to limits of  $\pm 10^{\circ}\text{C}$ . Fourteen temperature recording points throughout the length of the kiln are connected to potentiometric recorders and controllers of the latest design.

The firing system is unique in that it has been designed primarily for oil-firing, using heavy fuel oil, but provision has also been made within the kiln structure to use part, or all, of the volatiles given off by the charge as an additional heating medium. The controls mentioned above operate the oil fuel valves to give the correct firing temperature. Another interesting feature of the kiln is that there is no large brick-built stack. The control of the exhaust is effected by a venturi system which obviates the necessity for a large brick structure.

The kiln will be used for the production of all forms of carbon refractories, and will play an important part in increasing the already appreciable export business of this company. In addition to supplying the demands of the industry in the United Kingdom, Loxley distributes these products to such widely separated places as Norway, Sweden, Finland, Portugal, Holland, Belgium, France, South Africa and Australia.

## Sulphur Short Until 1955

### Experts Disagree About Position

**L**EADING U.S. chemical experts disagree about the present supply and demand position of sulphur. Some say the shortage is over; others insist that it still exists and is likely to continue.

One who believes that the world shortage has ended is Mr. Langbourne Williams, president of the Freeport Sulphur Company. New schemes now under way, he believes, will add 4,000,000 tons a year to world supplies by 1955.

Taking the opposite view is Mr. Paul Nachtman, president of the Mexican Gulf

Sulphur Co. 'Sulphur is still in critical short supply in the United States and the free world and will continue to be a chemical problem until at least 1955' he declared recently. 'After that date, the increased U.S. and Mexican production will alleviate but hardly cure the shortage. It threatens to be a continuing and vexing problem that will challenge every ingenuity in its solution.'

While his company plans to increase its sulphur production from 200,000 tons in 1953 to 500,000 tons in 1955, Mr. Nachtman said that past experience showed that with each progressive step in the development of new materials and products, demands for sulphur rose steadily higher. By 1975, he predicted, the annual demand for sulphur in the United States alone will be some 10,000,000 tons, or just over twice the amount consumed in 1950.

### Independent Survey

The reliable New York 'Journal of Commerce,' however, has just undertaken an exhaustive and independent survey of the sulphur position and reports that the supply-demand gap has been closed, due to a drop in demand for sulphuric acid. This drop can be traced back, it says, to the slump in the textile industry and the strike in the steel industry. About four-fifths of U.S. sulphur supplies are used to make sulphuric acid. Since it will be some time before the effects of the steel strike are overcome, adequate supplies of sulphur, it claims, are now available to meet long-term rising needs.

Since the sulphur shortage started with the outbreak of the war in Korea, consumers have been strictly conserving available supplies and producers have been developing new sources. Moreover, a goal has been set for the production of 8,400,000 tons of sulphur in the United States by 1955, of which 7,000,000 tons will be for U.S. needs and 1,400,000 tons for export. Nearly 100 new projects for sulphur production are now under way in the United States and overseas, says the *Journal*, and these should result in the production of an additional 4,040,700 tons of sulphur by 1955.

This new production will more than compensate for the expected decline in output from some existing sources, it adds. Furthermore, as about half of this new production will be in other countries, the world demand for U.S. sulphur should be eased considerably.—B.U.P.



# A Review of Phenol Analysis

## Part III d—Determination in Miscellaneous Products (i)

THE previous part of this review covered the quantitative determination of phenol in tars and allied products (see THE CHEMICAL AGE, 67, 219). This section, which concludes the series of articles, is in two parts, and will deal with the estimation of phenol in various miscellaneous substances.

(a) ESSENTIAL OILS: There are a large number of phenolic materials in the many naturally occurring essential oils, so only the more commonly occurring will be discussed.

Kariyone and Atsumi<sup>105</sup> have evolved a titrimetric method for the determination of thymol in mosla oil from *Mosla Japonica Maxim*. This oil contains thymol, *p*-thymol and other unknown phenolic compounds, and it is often contaminated with carvacrol. The method proposed is first to separate thymol from other phenols by crystallisation, and then to apply the iodine method. 10 g. of mosla oil are treated with 40 ml. of petroleum ether, and an equal amount of 5 per cent sodium hydroxide solution, and shaken in a separating funnel. After repeated extraction with sodium hydroxide, the oily layer is treated with 30 ml. of 15 per cent hydrochloric acid. An addition of a small crystal to the turbid liquid will cause complete precipitation of thymol. The crystals are washed free from any carvacrol with 10 per cent alcohol and cold water, and are redissolved in 5 per cent sodium hydroxide solution and the volume adjusted to 500 ml. 10 ml. of this solution are transferred to a 50 ml. volumetric flask, 50 ml. of 0.1N iodine solution added, and the volume adjusted to 500 ml. When 50 ml. of this is titrated with 0.1N sodium thiosulphate the percentage of thymol is equal to  $5 - S/18.764$  ( $S$  = ml. of 0.1N thiosulphate solution). If the amount of uncrystallisable phenols is not more than 9 per cent of the total phenols, the experimental error is within 2 per cent. Since mosla oil always contains less than 10 per cent, this method can be used with accuracy.

### Gravimetric Method

Thymol in Spanish oil of thyme can be determined with reasonable accuracy by a gravimetric method<sup>106</sup>. 25 g. of the oil are

shaken with 100, 80 and 50 ml. portions of 5 per cent sodium hydroxide solution, the alkali layer separated, collected in a 250 ml. flask, the volume adjusted to the mark and the solution filtered. A 200 ml. aliquote (=20 g. of oil) is acidified in a short-stemmed separating funnel with concentrated hydrochloric acid, and the precipitated phenols allowed to agglomerate. The liquid is cooled, the acid solution withdrawn, and the phenols run into a tared beaker containing a glass rod, and weighed. On stirring or seeding with a trace of thymol, the latter substance soon separates as tablets, especially if cooled in ice-water. The tablets are transferred to a weighed filter and the oil drawn off by suction.

### Carvacrol and Thymol

Sage and Dalton<sup>107</sup> used a freezing point method to determine thymol and carvacrol in Spanish thyme oils. Determinations were made of the freezing points of mixtures of pure carvacrol and thymol containing respectively 20, 30, 40, 50, 60, 70, 80 and 90 per cent of thymol by weight, and the results plotted with respect to temperature and percentage. The freezing point of pure carvacrol is approximately 0°C., and the melting point of pure thymol was found to be 49°C. For the assay of thymol samples, it is necessary to separate the combined total phenols by shaking with a 4 per cent sodium hydroxide solution in a boiling water-bath. After clearing, the alkaline solution is withdrawn and the oil washed well with water. The alkaline solution is then acidified, and the phenols extracted with petroleum ether, the ether solution dried with sodium sulphate, and the solvent evaporated, first in an open dish and finally on a water-bath at 33°C. The resulting mixture is then chilled and the freezing-point noted.

Reti<sup>108</sup> has devised an absorption apparatus (a 'phenolimeter') for the rapid determination of phenols in small quantities of essential oils. The apparatus is a modified type of butyrometer, the bulging portion of which has a volume of 20 ml., while the 9 cm. long contraction chamber has an inner diameter of 3.5 mm. and is graduated in 0.01 ml. divisions. The scale has a volume

of 0.8 ml. Pipette 1 ml. of the sample into the phenolometer, then sufficient dilute sodium hydroxide (5 per cent for thymol and carvacrol, 3 per cent for eugenol-containing oils) to permit the liquid to reach the upper portion of the scale on turning the apparatus. Close tightly with a rubber stopper and mix by turning and shaking. Place two of the phenolometers thus charged, and with stoppers pointing downward, in the metal holders of a centrifuge, first ascertaining that no bubbles interrupt the continuity of the liquid. Rotate for 3 minutes, then read off the volume of the non-phenolic layer. A later paper by the author<sup>100</sup> reported typical results for thymol in oil of thyme, carvacrol in marjoram oil and eugenol in oils of clove and pimento. When oils contain such a mixture as eugenol and acetyl eugenol (e.g., clove oil) which should both be determined as phenols, the dilute alkali should be added at 70-80°C., under which conditions saponification of the acetyl derivative to eugenol is complete.

#### Alkaline Extraction Unsatisfactory

Dodge<sup>100</sup> claims that the determination of phenols in oils by alkaline extraction is unsatisfactory, especially in oils of low phenol content, because of their variation in acid strength. The following method is stated to be fairly accurate, especially for oils containing up to 30 per cent of phenols:—

30 ml. of N sulphanilic acid in a 250-ml. flask (neck graduated 10 ml. in tenths) are chilled in ice and treated with 25 ml. of N hydrochloric acid and 25 ml. of N sodium nitrite solution. After 30 minutes, 10 ml. of oil (note temperature) and four 25-ml. portions of N sodium hydroxide solution are added, and shaking is continued for 30 minutes at 0°C. The phenol reacts with the diazosulphanilic acid formed to give a sulphonic acid, which will dissolve quantitatively in the acid solution. The flask is filled with N sodium hydroxide solution and allowed to return to normal temperature. For thymol mixtures, the non-phenol usually separates clearly and the volume may be read off. For eugenol mixtures the results are not satisfactory, because of the separation of an insoluble by-product.

(b) SOAPS: Semenov and Zaliopo<sup>101</sup> have modified the usual gravimetric determination of phenol in soap (precipitation as tribromophenol) and have obtained results accurate to 0.1 per cent by back-titrating the excess of

bromine reagent iodometrically. Shake 1 g. of shredded soap in 50 ml. of hot water (60-70°C.) until dissolved, precipitate with 10 ml. of 10 per cent calcium chloride solution, filter and wash the calcium soap with 25-50 ml. of cold water. Treat the filtrate with the bromate-bromide reagent (2.783 g. of potassium bromate and 10 g. of potassium bromide in 1 litre of water) and 5 ml. of concentrated hydrochloric acid, shake and stand for 15 minutes. Add 2 g. of solid potassium iodide, shake until dissolved, stand for 5 minutes and titrate with 0.1N sodium thiosulphate solution to a straw yellow; add some starch solution and continue the titration to a distinct blue. Run a blank.

A simplified determination of cresol in cresol soap preparations has been proposed by Kogan<sup>102</sup>:

Introduce 20-25 g. of sample into a 500 ml. distilling flask, add 50 ml. of 10 per cent barium chloride solution and distil the cresols with steam. Add 10 g. of sodium hydroxide to the distillate and remove hydrocarbons with benzene, petroleum ether or ether. On treating the aqueous solution with sodium chloride and hydrochloric acid, the cresols are precipitated. Extract with petroleum ether, dry over anhydrous sodium sulphate, filter the petroleum ether solution, wash the desiccant and filter with 5 ml. of fresh petroleum ether. Evaporate the solvent, dry at 100°C. for 30 minutes and weigh.

#### Direct Distillation Urged

Schmatolla<sup>103</sup> reported that it was difficult to free cresol from ether in the regular method of determination. He claimed that a direct distillation of the cresol acids, isolated from the soap by sulphuric acid, separated the cresols completely at 250°C. The non-aqueous layer of the distillate is run off and treated with sodium hydroxide, and concentrated hydrochloric acid added, when pure cresols float upon the sodium chloride solution. These are separated and measured in a graduated cylinder.

The method of Handke<sup>104</sup> for the determination of crude cresol in *Liquid Cresoli Saponatus* is based on the fact that the fatty acids present are precipitated by calcium chloride, while the crude cresol is held in solution by an excess of sodium hydroxide. Weigh 40 g. of 10 per cent sodium hydroxide solution, 20 g. of water and 40 g. of 10 per



ke 1 g.  
water  
e with  
e solu-  
up with  
filtrate  
.783 g.  
tassium  
ml. of  
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cent calcium chloride solution into a 200 ml. Erlenmeyer flask, mix thoroughly, then add 20 g. of the cresol soap solution, shake the reaction mixture for 1 minute and filter. Transfer 60 ml. of the filtrate to a cassia flask with 25 ml. of water, and add 30 g. of sodium chloride. Then add 15 g. of concentrated hydrochloric acid and sufficient water to raise the liquid column somewhat above the upper graduation. Mix thoroughly and read the volume of the precipitated crude cresol after 3-4 hours or after standing overnight. The number of ml. in tenths + 2 corresponds to the percentage cresol content of the soap solution. Report No. 6 of the Sub-Committee on Soap Analysis<sup>12</sup> deals with the determination of phenols in soap. Its findings may be summarised. Two methods in general use give good results:

(i) The soap is precipitated from an alkaline solution by calcium nitrate, and the phenols in the filtrate are determined by bromine absorption.

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(ii) The phenols are separated by steam distillation, and subsequently determined by bromine absorption. In the standard bromination test, 15 minutes was previously recommended, but this should be lengthened to 60 minutes to give constant absorption for concentrations of cresylic acids up to 0.045 per cent. The bromination temperature should be 15°-17°C. Since commercial cresylic acid is a mixture of *o*-, *m*- and *p*-cresol, it is necessary that the brominating reagent be standardised against cresylic acid of the same composition as that used in making the soap.

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## Japanese Seek Aid

Cheap Raw Material Sources Now Cut Off

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TECHNICAL skill and knowledge of modern methods is the first need of the Japanese chemical industry, and there are some hopes in Tokio that aid in this direc-

tion may be obtained from European chemists.

Mr. Ryutaro Hasegawa, chief of the Mitsubishi Chemical works in Tokio, expects to receive aid from German scientists in the production of chemical fibres. He would like to use Swiss methods of manufacture and management as models in his factory.

His company has already entered into an agreement with Monsanto Chemicals, under which the U.S. firm will send experts to Tokio to give technical assistance.

Japan's methods are about five years out of date, Mr. Hasegawa believes, and cannot therefore compete in international markets. Without some re-education of Japanese chemical workers, he does not believe that Japan can meet current prices.

On a recent visit to India, Mr. Hasegawa was amazed by the low price and high quality of Russian chemical products offered there. Before the war, he said, Japan could have met this competition, but today she is cut off from former supplies of cheap raw materials. For this reason, he believes that the Japanese chemical industry should concentrate on the production of chemicals from materials readily available in Japan.

The most readily available sources are limestone, coal and electric power. These, Mr. Hasegawa believes, must be exploited as far as possible before any attempt is made to buy expensive raw materials.—B.U.P.

## Ion-Exchange in Biscuits

SUFFERERS from heart ailments may soon receive recipes for cakes, biscuits, beverages, puddings and sweets along with a prescription from their doctor. Research at Eli Lilly & Company, the Indianapolis drug manufacturers, has developed a way for administering sodium-removing resins by means of special recipes. Acting somewhat on the principle of the common water softener, the drug removes excess sodium from the body and allows the diet to be seasoned more liberally with salt. The powder must be taken daily in large quantities.

Samples of biscuits containing Lilly's 'Carbo-Resin' were distributed at the recent convention of the American Medical Association and samples are now being distributed to medical men all over the United States together with recipe folders to be attached to prescriptions for sodium-removing resins.

## Water Pollution Research in 1951

### Wide Range of Experiments at Watford

THE need for better accommodation and increased staff, if it is to carry on its work to the best advantage, is emphasised in the report of Professor D. M. Newitt, F.R.S., chairman of the Water Pollution Research Board.

While the difficulty of providing new buildings at the present time is appreciated, the hope is expressed that work on the new central station (recommended in the first post-war report covering 1939-45), may be begun as soon as possible on the site at Stevenage.

#### More Staff Needed

Further staff are required because those at present engaged in the laboratory are almost fully occupied in dealing with work of immediate importance, and it is felt that, in an organisation of this kind, some proportion of its members should be able to devote attention to work which, though not expected to be of immediate practical importance, may well prepare the way for advances in the future.

The report, together with the survey by the director (Dr. B. A. Southgate, F.R.I.C.), of the Water Pollution Research Laboratory, Watford, is contained in 'Water Pollution Research, 1951,' published for the Department of Scientific and Industrial Research by HMSO (price 2s. 6d.).

Two series of experiments have been made, one at Coventry and one at Birmingham, on treatment of sewage by alternating double filtration. In the first of these, at Coventry, the effect of omitting a stage of sedimentation, between the primary and secondary filters, was examined. The results agreed with those previously obtained with larger plant at Birmingham. There was some deterioration both in the quality of the final effluent and in the condition of the filters but the effect was comparatively small.

In the second experiment some of the filters used were fitted with electrically driven rotary distributors so that the speed of rotation could be altered. The efficiency of the process has so far increased as the speed of rotation has been reduced. The lowest speed tried, at present, was one revolution in 30 minutes.

It has been shown that vigorous growth of some of the fungi found in percolating filters depends on the supply of a number of trace metals such as copper, cobalt, and zinc, and of the Vitamin B complex.

Experiments were continued at Stivichall in collaboration with the Gas Research Board. It was shown that addition of spent gas liquor of the ordinary type to sewage caused an appreciable deterioration in the quality of the effluent produced by biological filtration.

No adverse effect was caused, however, by adding a similar concentration of spent liquor from the gas works at Hinckley. Here the liquor does not include retort-house liquor and the hot gas is treated in electrostatic precipitators with the object of reducing the concentration of 'higher tar acids' in the liquor.

Work was carried out at the laboratory by a member of the staff of the Royal Cancer Hospital on the effect, on processes used for treatment of sewage, of five commonly used radioisotopes—those of sodium, phosphorus, cobalt, bromine, and iodine. None of these substances was adsorbed to any great extent on sewage sludge. In secondary treatment by biological filtration or by the activated-sludge process, there was little adsorption of sodium bromine, or iodine, but phosphorus and cobalt were strongly adsorbed.

#### Penicillin Effluents

Particulars are given of the composition of waste waters from the manufacture of penicillin and methods for treating these liquors described. It was concluded that, at a town in the north of England, the waste waters from a penicillin factory could best be treated with the sewage of the town.

During 1951 the London County Council made a large experiment in which part of the sewage effluent discharged to the Thames Estuary was chlorinated. No significant effect was observed on the condition of the estuary water, which from July to October was completely de-oxygenated over a distance of several miles. Sulphide was usually present in the water in this part of the estuary.

# Toxicity of Effluents to Fish

## WPRL Tackling Difficult Problems

UNDER the River Boards Act of 1951 England and Wales have been divided into areas and a Rivers Board has been set up to administer the rivers in each area. The Boards have power to make by-laws which are subject to confirmation by the Minister, for whose guidance a Departmental Committee has been set up.

One of the most difficult problems involved in the control of pollution is to determine the possible effects of industrial and household effluents on fish. The Ministry of Agriculture and Fisheries have announced their intention of setting up a laboratory in which routine tests of toxicity can be undertaken. There are many questions to be answered, however, before the reliability of any test can be appraised. What is the variability in resistance of population of the test fish? What is the effect of age and size? How accurately must such factors as temperature, oxygen and pH be controlled during tests?

The Water Pollution Research Laboratory are carrying out the background work on which the Ministry's tests will be based and have been engaged on this long and complex investigation since 1949. A large number of fish are being used in this research and the reproducibility of susceptibility to toxicity in a population is being examined. In any routine test, however, there is a limit to the number of fish which could be used, if only on economic grounds. A balance must therefore be maintained between practical requirements and scientific accuracy.

### Two Related Aspects

There are two closely related aspects of the main problem. If the relationship between concentration and survival time over a fairly short period is known, a basis is available on which the effect of any given poison in an effluent can be measured. This knowledge can also be used as a basis for assaying one effluent in terms of another. Sufficient information would be available, for example, to set up properly designed tests for comparison of two alternative pilot plant processes for an effluent treatment.

The second and much more important requirement is to determine what concentra-

tion of a particular effluent can be permitted in a stream without harmful long-term effects. If an effluent is being continually discharged it is of little practical importance whether it will kill fish in an hour, two days or three weeks. Yet in laboratory tests experiments are necessarily of fairly short duration and cannot last longer than a few weeks. Thus an assessment of the long-term effects of a concentration must be made on the basis of comparatively short tests. It becomes very important, therefore, to find out what relation a short-term result bears to the known effect of a known dilute solution on survival times. In other words, to determine a safe concentration of a poison it is necessary to know how survival time varies with concentrations too low to produce an effect rapidly.

### Resistance to Cyanide

The resistance of rainbow trout to cyanide is being investigated by the Water Pollution Research Laboratory. The method adopted is to keep the fish in a constantly flowing stream of well-aerated water into which a measured quantity of cyanide is introduced. The main supply of water is passed through a filter to remove any residual chlorine and thence into a tank maintained at a constant level. From this tank it is discharged at a constant rate through an orifice into a pipe to which the poison is admitted at the desired rate by means of hypodermic syringes operated by heart-shaped cams. The water and cyanide then pass through a system of mixing vessels before being admitted to the test tank.

When the effects of the poison begin to be experienced the fish gradually lose their sense of balance and start swimming sideways or on their backs. If promptly removed from the tank when these symptoms appear they quickly recover and no appreciable lasting effects have been detected.

One of the initial requirements was to develop a chemical method of estimating the concentration of the poison under investigation to a sufficient degree of accuracy. W. A. Robbie had previously found that the lowest concentration of cyanide which could be determined by the phenolphthalein method

was 0.25 p.p.m., the error at this concentration being about 3 per cent. It has now been shown, however, that 0.05 parts CN per million can be determined if the colour produced in the phenolphthalein reaction is measured in cells 20 cm. long in a Spekker photoelectric absorptiometer. At these low concentrations, however, the method is very sensitive to slight differences in technique and to differences in the quality of the water used for dilution. A particular sample of tap water usually introduces a constant error, however, since the curves relating intensity of colour to concentration of cyanide, though not coincident, always have the same slope.

#### Method of Comparison

The method now used, therefore, is to compare the colour given by water from the tank in which fish are tested (to which a solution of cyanide has been added by means of a mechanical pump) with that given by the same tap water to which known amounts of cyanide are added by pipette. In carrying out the determination it is important that the pH value be kept between 10 and 11, and that the temperature should be the same in the standard and in the unknown solution. Using these modifications concentrations of about 0.15 part CN per million can be determined with an accuracy of plus or minus 2 per cent.

The results of toxicity tests have been expressed in many ways. The commonest method is to state the lowest concentration of poison tested in which fish die during the period of the test. Various terms have been assigned to these concentrations, such as 'lethal limits' and 'the minimum harmful concentration of a toxic substance.' Such terms should be treated with caution, however, since they define the highest concentration at which fish do not die before some fixed time has passed, and not the concentration below which the poison is harmless.

Another method of interpreting the results of toxicity tests with fish has often been used in Britain and is derived from Powers' study of the effect of poisonous substances on goldfish. Powers found that with most poisons there was a range of concentration over which survival time was inversely proportional to concentration, and that a straight line resulted if the reciprocals of the survival times within this range were plotted against concentration. Data obtained at the Water

Pollution Research Laboratory by testing rainbow trout in various concentrations of cyanide have been plotted in this way.<sup>1</sup> The continuous line through the points is similar in shape to the sigmoid curve usually obtained by Powers, and if the broken straight line is drawn through the central part of the curve where the slope is steepest, it cuts the concentration axis at about 0.14 parts CN per million. In practice, fish die in concentrations much lower than this, so the method provides an adequate description of the data for the lower concentrations.

At the Water Pollution Research Laboratory it has been found that in concentrations of cyanide the survival time of rainbow trout is inversely proportional to a power of the concentration. Between 0.25 and 0.07 part CN per million the power is 5.67, and there is no reason to suspect a departure from this law in any of the concentrations tested below 0.25 part CN per million. The relation can be expressed by the equation:

$$n \log C + \log T = \log k \\ \text{or } C^n T = k$$

where 'C' is concentration of poison in parts per million, 'T' is the median survival time, in minutes, of the fish tested, and 'n' and 'k' are constants.

The effect on fish of concentrations of poison lower than those which produce an effect rapidly enough for it to be measured by routine laboratory tests, can only be inferred by extrapolation from data obtained by tests in more concentrated solutions. The equation implies that no matter how low the concentration of poisonous material, the water will still exert some lethal effect on the fish population. In the case of very low concentrations, however, deaths due to poisoning would represent such a small proportion of the total mortality from all causes as to be completely insignificant. Another possibility is that for some poisons, or for any poison, there might be a concentration at which the poison has no harmful effect on the population at all. If so, the correlation which has been found cannot describe data lower than a certain concentration.

#### Range of Survival Times

Work at the Water Pollution Research Laboratory has shown that rainbow trout of the same age and size, reared under similar conditions, and subjected to the same treatment before and during a test in cyanide

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solution, have a wide range of individual survival times. In one test 42 similar yearling rainbow trout were tested together in water containing 0.14 parts CN per million at 17°C. The first overturned after immersion for 29 minutes and the last after 207 minutes. From a series of tests carried out in the same concentration over a period of three weeks, it was found that the fish always turned over in approximately the same order. Because of this variation in resistance any estimate of toxic effect such as median survival time will be subject to sampling errors, and the more fish that are used the more accurate the test will become. If the factors which make for high or low resistance are inherited, it might be expected that in a mildly poisonous stream in which fish are able to breed naturally, the population as a whole would tend to be selected from the more resistant fish. Do individual fish become more or less resistant if they live for weeks or months in very low concentrations of poison? This is another of the many questions which have not yet been answered.

One factor which may be of importance in determining the susceptibility of a fish is its size. An experiment made with a batch of rainbow trout in which the length of individuals ranged from 5.5 to 17.75 cm. indicated that susceptibility to poisoning by cyanide increased significantly with increase in length.

**Apparatus to Study Effect**

In order to study the effect of oxygen content on the apparent toxicity of a direct poison, an apparatus has been constructed at Garston which will provide a stream of water containing a constant concentration of dissolved oxygen. It consists of a vertical cylinder 8 ft. high and 4 in. in diameter, down which passes tap water saturated with oxygen and at constant temperature, and up which passes a stream of nitrogen gas. With a fixed setting of the gas regulator the concentration of dissolved oxygen in the water can be maintained for several hours to within plus or minus 0.2 p.p.m. of any chosen value in the range 0.8 to 8.5 p.p.m. This variation is greater than is desired, however, and automatic equipment has been devised which will vary the rate at which the nitrogen is blown through the stream of water passing down the cylinder according as the concentration of oxygen in the water in the testing tanks falls below or rises above the chosen value<sup>1</sup>. In the apparatus as used

at present, dissolved oxygen concentrations down to 0.02 part oxygen per million can be maintained in the test tank. In preliminary tests at 12°C. rainbow trout survived for at least three days in concentrations of 2.0 parts oxygen per million, but in concentrations below about 1.2 parts oxygen per million all the fish died within two hours.

**Affected by Temperature**

Early investigators found that the resistance of fish to poisons was affected by the temperature difference between the water in which they had been living and that in which they were tested. Some of the work of the Water Pollution Research Laboratory on the effect of temperature on response to cyanide has suggested that acclimatisation to the experimental temperature for several weeks before testing would be needed to bring the resistance to a steady state. Still less is known about the effect on resistance to poison of other environmental conditions such as diet and chemical properties of the aquarium water. Seasonal differences in resistance may also occur.

It is known that the behaviour of different poisons on fish varies considerably, but so far the Water Pollution Research Laboratory have only been able to study the effects of a single poison—cyanide. The results that are being obtained with regard to such variables as temperature, pH and oxygen content may or may not hold good with other poisons. In routine tests the examiners may be unaware of the identity of the particular poison under test, which might be unknown even to the firm concerned. It is hoped in due course to extend the investigation to include other poisons.

The Water Pollution Research Laboratory is co-operating with the Ministry of Agriculture and Fisheries in a survey of polluted streams<sup>2</sup>. The aim is to find a river—or possibly a number of rivers—in which pollution by some poisonous substance occurs at some point. The results obtained from a partly poisoned river will then be compared with those of laboratory tests on the same poison. By this means it may be possible to make some reasonable assessment of a concentration as a basis on which fairly rapid biological tests might be devised.

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## U.S. Coke & Coal Chemicals in 1951

### Gains Recorded All Round

A NEW high level in coke production in the United States was attained in 1951, according to data submitted by coke producers to the Bureau of Mines. A total of 79,330,702 net tons of coke, excluding breeze, was produced, which represented a gain of 9 per cent over the 1950 output and exceeded the previous maximum of 1948 by 4,468,774 tons.

This record was made possible by the efficient co-ordination of labour and management in the mining, transportation, steel, and other basic industries, which permitted coke producers to maintain extremely high operating rates throughout the year. Slot-type coke ovens operated at the second highest production rate on record—96.5 per cent of capacity, compared with a record rate of 96.9 per cent achieved in 1942 during the last war. Beehive-coke production, the highest since 1943, declined slightly in the latter months of the year from the high rate in January and was 9 per cent of the total coke production.

#### Biggest Problem

One of the major problems that confronted the coke industry in 1951 was providing sufficient coal-carbonising capacity to support the double burden of the accelerated general industrial activity and the defence programme. A total of 696 new slot-type coke ovens with a designed annual coke capacity of 3,869,100 tons was completed, while 359 ovens, having an annual coke capacity of 1,709,100 tons, were taken out of production. Most of the 359 ovens were shut down for rebuilding, although one coke plant with 42 ovens closed permanently and several batteries at other plants were completely demolished. Although the difference between capacity of the new ovens completed and old ovens taken out of production was 2,160,000, the net gain in potential capacity during the year was only 1,740,200 tons. This was due to slowing down the coking cycles for the older ovens during the year.

Of all slot-type coke ovens in existence on 31 December, 1951, 52 per cent were at least 20 years old. Many of these ovens were reported to be in poor physical condition

and coke producers were faced with the difficult task of maintaining existing capacity as well as constructing additional ovens to support the expansion in the iron and steel industry. In an effort to meet the planned expansion goal for coke capacity, the industry had 1,446 new ovens with a designed annual coke capacity of 8,134,500 tons under construction on 31 December, 1951, and contracts for a number of additional batteries were pending. However, all of the new construction will not represent additional capacity, as a large part will actually be replacement of badly deteriorated ovens.

Production of basic chemical raw materials, which generally parallels oven-coke output, also reached new peaks in 1951. Increases of 8 per cent, 9 per cent, and 8 per cent over 1950 were registered by ammonia (all forms), crude light oil, and tar, respectively. These gains resulted in corresponding increases in the output of derivatives as follows: benzole (chemical grades), 12 per cent; toluol (all grades), 12 per cent; xylol, 13 per cent; naphthalene, 31 per cent; creosote oil, 14 per cent; crude chemical oil, 41 per cent; refined pyridine, 26 per cent; ammonium sulphate, 8 per cent; and ammonia liquor, 6 per cent.

In spite of the gains in output of benzole and naphthalene, requirements exceeded production from domestic sources and considerable quantities of these commodities were imported from abroad. Although the supply of virtually all of the principal coal chemicals was limited, they were not placed under allocation control and only directive actions were taken from time to time on some of the scarcer commodities, particularly toluol for use in explosives and benzole to fill in spot shortages where urgent need arose.

#### Californian Earthquake Fires Refinery

The severe earthquake which recently shook California has caused the shutting down of the Paloma refinery—owned by six oil companies and operated by the Western Gulf Oil Company. It is not known when the refinery will be on stream again. Damage has been estimated at \$1,000,000.



# Carborundum Develop New Fibre

## High Temperature Insulator & Super-Filter

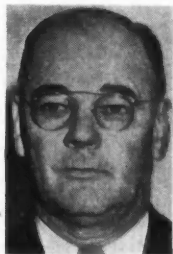
DETAILS of a new synthetic fibre that may solve many critical industrial and defence problems were disclosed on 6 August by The Carborundum Company, Niagara Falls, New York. The new material is trademarked 'Fiberfrax'; it resists temperatures that melt cast iron, yet its fineness is such that it can be used as a super-filter, or as a base for entirely new types of insulation, and fireproof and electrical papers.

'Fiberfrax' is the latest product of the continuing research at The Carborundum Company, which manufactures silicon carbide and aluminium oxide, which it processes into bonded and coated abrasives, super refractories, electric heating elements, and electric resistors. The new fibre is a kindred product: its raw materials are aluminium oxide and sand, its manufacture involves the same type of electric-furnace melting that produces aluminium oxide abrasives. No critical materials, such as platinum, are required in the production equipment.

At the present time 'Fiberfrax' is finding applications as high-temperature insulation in combustion and exhaust systems of jet engines and it is under study by the Office of Naval Research for use in highly specialised papers. It is claimed that it can replace or be combined with critical asbestos in many electrical and thermal uses. It can be bonded into insulating panels that will not

only resist fire and prevent heat loss, but will also deaden sound. As a filter, it is said that 'Fiberfrax' can improve the efficiency of gas and fume filtration.

Its inertness makes possible cleaning and re-use of the material without loss of filtering efficiency. Studies of potential use indicate that the material may be suitable for



Mr. H. C. Martin,  
director of  
research

heavy-duty brake linings, as the strength-supplying component in formed plastic laminates like radomes and body armour, in high-temperature gasketing, for vibration dampening, and as a flame filter to remove ash in gas turbines. In many applications, its light weight (only 2 lb. per cu. ft.) will prove especially advantageous.

Pilot production equipment at the Carborundum Company's works can produce the material at the rate of 30 tons a month. It is so new that exhaustive properties tests have not been completed and are still under way. Its unusual characteristics have in some cases made it necessary for technologists to devise special testing procedures.

According to Harry C. Martin, Director of Research, its properties make it desirable for use in the aviation, electrical, papermaking, and chemical fields. Thus this new research development will inevitably lead to a wide expansion of the company's marketing activities.

'Fiberfrax' fibre is made by melting aluminium oxide and sand in an electric furnace, then subjecting a stream of the molten lava-like material to a controlled blast of air. The molten material is blown into a fluffy mass made up of random arrangements of extremely fine fibres. The fibres range up to



When solid aluminium silicate (right) is melted and subjected to a blast of air, fluffy cotton-like 'Fiberfrax' fibre (left) is produced. In samples shown, weights are equivalent



**'Fiberfrax' fibre against heat.** *A quarter inch thick mat of the material placed over a Bunsen burner is cold to the touch*

3 in. in length and have an average thickness of about one-twenty-fifth that of a human hair, about one-fourth that of fine silk. Although it is produced and collected in a fluffy mass, the fibre eventually will be processed into felted blankets, firmly bonded batts, tape, and paper-like forms.

Melting of the alumina and silica is done at 3,300°F. 'Fiberfrax' fibre easily withstands 2,300°F. without loss of properties and does not soften at temperatures approaching 3,000°F. Its inert raw materials provide corrosion-resistance, electrical properties, and low thermal conductivity. The fineness of the fibres and their random arrangement produce the efficient filtering abilities of the material, and also account for the fact that 'Fiberfrax' fibre has pronounced capillary characteristics that allow it to lift liquids without absorbing them.

Carborundum's research engineers came upon the material during their early work on alumina 'bubbles' which are extensively used as insulation in high-temperature commercial applications. The bubbles are made by blasting molten alumina with air. During this operation, it was noted that occasionally fibres were formed. By working with alumina and silica, developing modifying agents,

and by extensive experimentation with temperatures and air-blast pressures, the researchers were able to carry the blowing process beyond the bubble stage, and in effect blow each bubble into a fine fibre.

As now produced it can compete directly with extremely fine glass fibres in many applications. Chemical data are still being evaluated, but Carborundum research tests indicate that the material's inert source and very low alkali content make it highly resistant to acid attack.

Insulation tests are said to show that 'Fiberfrax' fibre, as compared to high-quality refractory insulating brick, can make impressive savings in weight and furnace efficiency. The savings are significant enough to make the material directly competitive even at the pilot-plant price of \$1 a pound. Compared to high-quality cemented refractory insulating brick, tests show that 30 per cent less electrical power is required to maintain furnace equilibrium at 2,500°F.; time required to bring the furnace up to temperature is cut in half.

At the present time, an extensive programme of tests is now under way by Carborundum. Samples of the material are also out on product test with a number of manufacturers. In the meantime, Carborundum is proceeding with a \$500,000 plant expansion programme to make 'Fiberfrax' fibre in greater quantities and thus reduce unit cost.

## Iron & Steel Price Changes

PRICE increases for some qualities of alloy steel and stainless steel products came into force on 25 August under a new Iron and Steel Prices Order announced by the Ministry of Supply. The revision has been necessary owing to the changes in production caused by measures taken to conserve nickel and molybdenum and to take account of the increases in the prices of alloy materials. The Order removes blast furnace ferro-manganese from statutory control. The price will in future be fixed by agreement between the makers and the Ministry of Supply.

## New Power Unit in Operation

The first of five 54,000 horse-power generating units which will supply power to the new 50,000-ton smelter of the Aluminium Company of Canada at Ile Maligne is now in operation, it is announced.



# Cellulose from Banana Stalks

## Progress in Brazilian Industry

A METHOD of extracting cellulose from the stalks of banana trees by the Polpex process was recently reported on by the Brazilian Geographical and Statistical Institute. The method is strongly recommended as an alternative to the more lengthy and costly process in general use for eucalyptus and other woods, which call for high temperatures and pressure and a considerable expenditure of sulphite or caustic soda.

Demand for cellulose is increasing rapidly in Brazil, not only for making paper, but as the raw material for vegetable silk, celluloid, cellophane, plastics, explosives and numerous other products now manufactured locally and which cannot be made from the impure substitute paste. The institute points out that the cellulose derived from banana trees is identical to that obtained from *Musa textiles*, a plant recognised as a useful source of cellulose for industrial use.

Brazil imported 113,256 tons of cellulose in 1951 and in the same year one State alone, namely Sao Paulo, produced over 24,000,000 bunches of bananas, which means that a potential yield of 110,000 tons of cellulose was neglected. This quantity, the institute claims, could have been economically extracted without high temperature, sulphite or caustic soda by the Brazilian Polpex process, which was evolved after prolonged experiments and patented in Great Britain by Dr. Francisco Garcia Leao.

### Reduction to Bagasse

By this method, after gathering the fruit, the stalk may be reduced on the site to bagasse, which has a 90 per cent cellulose content and can be conveyed directly to the factory, minimising transportation costs. The tree will grow again without planting and attain maximum development in 12 to 18 months. Any impurities in the cellulose are destroyed by chemical treatment in three to five per cent solutions of national products, at small cost. The simple machinery and accessories required are manufactured in Sao Paulo and the Federal District and the cost of equipping a factory is estimated at 85 per cent less with the Polpex process than for extracting the same quantity of cellulose from wood.

The former Federal Council of Foreign Trade considered the Polpex process as the most suitable for Brazil and recommended that the government assist financially in the establishment of the industry in Rio or Sao Paulo, the chief banana-growing states. President Vargas approved the recommendation.

The Polpex patent, registered in London under No. 28,512, has been transferred to a Brazilian firm, *Companhia de Celulose Banex*, with a registered capital of £60,000. The company has the exclusive right to use the patent in Brazil and is now raising its capital to £110,000. This is the amount estimated necessary to install plant with capacity to produce 10 tons of cellulose per eight-hour day.

### Amounts Needed

As regards raw material, each stalk of the banana tree weighs a minimum of 35 kilos and contains 10 per cent, or 3.5 kilos, of cellulose. Production of 10 metric tons of cellulose daily would, therefore, call for 75,800 stalks for a year of 300 working days. Allowing 400 trees per hectare (2.47 acres) the area of the plantation, including buildings, needed to keep the factory supplied, would be 200 hectares. Extensive banana groves exist near the site of the proposed factory.

Joint stock companies manufacturing chemical and pharmaceutical products in Sao Paulo and the Federal District, excluding private and limited liability companies, in 1951 numbered 287 with a total registered capital of £45,000,000. An examination of the balance sheets of 19 Brazilian companies showed that these increased their capital plus reserves by 26 per cent in 1951, to £6,552,000, while the percentage of profits on capital plus reserves rose from 18.8 to 22.6, and that of dividends distributed, from 7.0 to 8.3 on registered capital. In seven companies, formed with foreign capital, capital plus reserves was raised 22 per cent in 1951, to £7,876,000, profits on capital plus reserves increased from 19.5 to 22.1 per cent and dividends on capital from 7.5 to 12.1 per cent.

Among recent new developments are the

following: *Pfizer Inter-Americana S.A.* has been authorised to manufacture chemical and pharmaceutical products in Brazil; *Companhia Rhodia Brasileira* is to make nylon in Brazil under patents held by Du Pont de Nemours. The German firm, *C. A. Schleussner*, has been authorised to build a factory to manufacture photographic supplies in Sao Paulo.

Imports of chemical and pharmaceutical products increased from 490,003 tons, valued at £25,875,000, in 1950 to 696,433 tons, valued at £51,640,000, in 1951. Imports of colouring substances, not included in the above totals, increased from 15,660 to 17,230 tons, and synthetic resins and similar raw materials from 19,089 to 24,479 tons. In January, Brazil's imports of chemical products rose by nearly 100 per cent, as compared with January, 1951, and reached 51,272 tons.

During the last fortnight in June, 14 per cent of the licences issued by the Export-Import Department were for purchases in the United Kingdom. The value of licences to import British chemical products amounted to £24,181.

## Sulphuric Acid Returns

### Production & Stocks Reduced

PRODUCTION of chamber and contact sulphuric acid in the United Kingdom in the second quarter of 1952 was 346,521 tons of 100 per cent  $H_2SO_4$ , compared with 417,807 tons in the first three months of the year.

Consumption from 1 April to 30 June, 1952, at 358,886 tons was 79,933 tons lower than in the period 1 January to 31 March, but stocks of sulphuric acid and oleum at the end of June totalled 74,017, a reduction of some 5,000 tons on the figures at the end of March.

These figures and the following tables are taken from the Summary of Monthly Returns for the United Kingdom issued by the National Sulphuric Acid Association, Ltd.

PRODUCTION OF SULPHURIC ACID AND OLEUM  
(Tons of 100 per cent  $H_2SO_4$ )

Data referring only to Acid Makers' Returns	Chamber only	Contact only	Chamber and Contact
Stock, April, 1952	31,756	47,730	79,486
Production	130,227	216,294	346,521
Receipts	15,095	8,832	23,927*
Oleum feed	—	1,809	1,809
Adjustments	-60	-151	-211

Use	70,181	105,550	175,731
Despatches	77,680	124,104	201,784
Stock, 30 June, 1952	29,157	44,860	74,017
Total capacity represented	194,220	315,350	509,570
Percentage production	67.1%	68.6%	68.0%

\* Includes 1,487 tons of imported acid.

### RAW MATERIALS (Tons)

Data referring only to Acid Makers' Returns	Pyrites	Spent Oxide	Sulphur & $H_2S$	Zinc Concentrates	Anhydrite
Stock, 1 April, 1952	132,406	244,461	86,036	59,836	870
Receipts	84,238	56,077	57,735	35,933	35,843
Adjustments	+287	+298	-810	+10	—
Use	49,621	53,268	52,861	40,490	35,843
Despatches*	362	3,086	664	4	—
Stock, 30 June, 1952	166,948	244,482	89,436	55,285	870

\* Including uses for purposes other than sulphuric acid manufacture.

Note.—The above figures include production at Government plants where those plants are producing acid for trade purposes.

### CONSUMPTION—UNITED KINGDOM (1 April-30 June, 1952)

Trade Uses	Tons 100% $H_2SO_4$
Accumulators	2,143
Agricultural purposes	2,412
Bichromate and chromic acid	3,520
Bromine	2,983
Clays (Fuller's earth, etc.)	1,690
Copper pickling	506
Dealers	2,517
Drugs and fine chemicals	3,374
Dyestuffs and intermediates	7,172
Explosives	5,261
Export	497
Glue, gelatine and size	128
Hydrochloric acid	12,775
Hydrofluoric acid	3,059
Iron pickling (including tin plate)	25,024
Leather	531
Lithopone	1,363
Metal extraction	505
Oil refining and petroleum products	17,835
Oils (vegetable)	2,231
Paper, etc.	791
Phosphates (industrial)	5,602
Plastics, not otherwise classified	26,916
Rayon and transparent paper	2,211
Sewage	2,651
Soap and glycerine	146
Sugar refining	68,616
Sulphate of ammonia	6,827
Sulphates of copper, nickel, etc.	812
Sulphate of magnesium	84,167
Superphosphates	4,504
Tar and benzole	4,115
Textile uses	23,699
Titanium oxide	32,112
Unclassified	358,886*
Total	

\* Includes 2,408 tons of imported acid.

The above figures show the two items 'Lithopone' and 'Titanium Oxide' which have previously been included under 'Paint and Lithopone.' The small quantity of acid used for paint is now included in 'Unclassified.'

### Fluoridation of Water in the U.S.A.

The U.S. Public Health Service, according to a report in *Chemical Week*, is continuing to urge fluoridation of public water supplies, despite the warning of the Delaney Committee that such encouragement may be premature.

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## The Chemist's Bookshelf

**COLLOID SYSTEMS. VOLUME II. REVERSIBLE SYSTEMS.** Edited by H. R. Kruyt. 1949. Elsevier Publishing Company Inc. Distributed by Cleaver-Hume Press, Ltd., London. Pp. 753. Price 90s.

In no field of physical science has a Dutch school of workers earned greater distinction than in the complex field of colloid and macromolecular chemistry. Much of the original Dutch literature is relatively inaccessible to English and American readers and it is clear that one of the main editorial objects has been to remedy this defect. While this worthwhile object has no doubt been achieved, a secondary result has been to upset somewhat the balance of the volume, an undue proportion of space being allotted to detailed experimental work from the Dutch laboratories. Thus, English and American readers may well be surprised to find only 42 pages out of a total of 722 devoted to association colloids, including colloidal electrolytes.

The book consists of a series of self-contained articles by authors with such well known names in colloid science as H. G. Bungenberg de Jong, J. J. Hermans and J. Th. G. Overbeek. The volume opens with a rather laboured introductory section in which the objects of the work are set out at some length and a classification of colloid subjects attempted. Chapters follow on the structure of macromolecules, the thermodynamics of polymer solutions, coacervation and flocculation, gels and association colloids. Such important topics as the sedimentation methods of studying particle size and the optical techniques are dealt with briefly and in a general way, reference being made to the many excellent existing monographs. The most useful sections are, undoubtedly, J. J. Herman's lucid treatment of the thermodynamics of long chain polymer solutions and Bungenberg de Jong's summary of experimental work on the phenomenon of coacervation. Here the writer is thoroughly at home and the reader is left with an impression of vast enthusiasm

combined with untiring work in the laboratory. This particular section, on the other hand, can hardly be regarded as critical since out of 44 references to the literature in one chapter no less than 43 are to the writer's own publications.

Generations of writers on colloid science have been at pains to emphasise the difference between the systems they have designated as colloidal and 'true' solutions. Now, as the Dutch school is so ably demonstrating, we are being forced more and more to the conclusion that 'there is no essential difference between a solution of micromolecules and one of macromolecules . . . It is only as a result of their particularly large size that macromolecules sometimes exhibit a behaviour which does not have its counterpart in micro-physics, or that they occur in forms which do not exist in the micromolecular field'. And so the wheel of colloid science turns full circle.

The book is well produced and lavishly illustrated with excellent drawings and explanatory diagrams but the translation could better be described as workmanlike than inspired. Many phrases such as 'In second place comes the interest for two or more phase equilibria . . . ' will surely sound strange in English ears. For those however whose research lies in the colloid field this volume is a necessity.—R.C.P.

**ANORGANISCHES GRUNDPRAKTIKUM.** By Carl Mahr. Verlag Chemie, GmbH., Weinheim/Bergstrasse. 1952. Pp. XIV + 332. Dm. 15.

In this book the author has set himself the task of presenting the fundamentals of inorganic chemistry and chemical method through the medium of chemical practice and experiment. Experiment has always been the essential background to all scientific advance, since it alone can verify or even demonstrate conclusions reached in theory, and chemical analysis has generally been an eminently suitable means of thus introducing the groundwork of chemistry to the

student for over a century. The first writer on chemical analysis was unquestionably Karl Remigius Fresenius, with his books on qualitative (1841) and quantitative (1845) analysis, which were for a long time valued as standard books on the subject.

In the present book the author divides his work into three parts. The first aims at a comprehensive description of the equipment and instruments used in the laboratory, and the fundamental principles of physico-chemical research. The second part deals with fundamental inorganic practice and lists the various elements and compounds and their reactions. The third part is devoted entirely to qualitative analysis. Throughout the book some 450 experiments are described, with the help of 53 figures and 16 micro-illustrations. Many details of reagents, apparatus, reactions, and even first aid in case of accident, are included, and the book has an extensive index. Altogether it is well arranged and comprehensive and should be of value to students and teachers alike—their knowledge of German permitting.—F.N.

#### PRAKTIKUM DER GEWERBLICHEN CHEMIE.

By Max Hessenland. Third edition by Fritz Tegerd. Carl Hanser Verlag, Munich 1952. Pp. 345. Dm. 26.

After the death of the original author in 1945 the present third edition of this well-known book was re-written, completely revised, and considerably extended by Fritz Tegerd. The demand for the book, steadily maintained since the publication of the first edition, 1937, is gratifying proof of its utility.

Although the present book is based upon former editions of the 'Hessenland,' it deals in greater detail with the chief problems which have attracted the attention of industrial chemists during the last ten years, bringing them up to date. Similar textbooks deal mostly with theoretical-scientific experiments and problems. This is all right for the student of pure chemistry but not for one who intends to enter industrial practice. This 'Practicum of Industrial Chemistry' presents, in 444 experiments and tests, essential problems of practical chemistry met with daily in trade and industry. After an introduction to work in the chemical laboratory and its equipment, it also deals with dangers and first aid.

The main text of the book is divided into

175 experiments in inorganic and 269 experiments in organic chemistry. These deal with analyses, syntheses, raw materials and finished products, their uses and manufacture. The text is supplemented by 60 instructive illustrations and numerous tables and where the working details are too lengthy for inclusions, references to the methods are quoted in foot-notes. An alphabetical list of the experiments and a subject and names index makes the book a handy laboratory guide.—F.N.

CHRONOLOGISCHE UBERSICHTSTABELLEN ZUR GESCHICHTE DER CHEMIE. By Paul Walden. Springer-Verlag, Berlin. 1952. Pp. xi + 118. Dm. 12.60.

This little historical reference book is subtitled 'from the earliest times to the present day', and in so far as this is possible it fulfils its purpose.

The earlier chapters, dealing with chemistry in the period a.c., in the period from the beginning of the present era up to 1500, from 1500 to 1697, and in the 18th century, are, naturally, relatively slight, but contain a considerable amount of information not readily available otherwise, in a form that it easy for reference. Even in the last of these chapters the amount of material is becoming so copious that it is confined to relatively brief entries in chronological order, followed by a general discussion, in a few pages, of trends during the century.

Chapters V and VI, dealing with 19th and 20th centuries respectively, are sectionalised into inorganic and general chemistry on the one hand, and organic chemistry on the other, and each of these chapters has a section reviewing the general lines of advance. The entries are quite numerous up to 1950 and a very few references to 1951 are included. The usual practice is to give the year, the chemist, the discovery or advance associated with him or attributed to him, and a reference or references to the original literature. It is in this last respect particularly that the book will prove valuable to students of the history of chemistry.

Transliteration of names has been free, and not always accurate, so that to British eyes names such as Rob. Boyle, Thom. Graham, Baco von Verulam and Smiths. Tennant will read somewhat strangely. But the book as a whole contains a large amount of useful historical information, and seems to be very comprehensive.—w.

# HOME

## Practical Aid

Dunlop has sent £100 to the Lynmouth Relief Fund and footwear shops in the Lynmouth area have forwarded 50 pairs of Wellingtons from the footwear division to the British Legion in Lynton.

## Textile Institute Examinations

Two women candidates were among the successful students who sat for the general textile technology examination of the Textile Institute. Of the 212 entrants, at 13 centres throughout the world, 98 passed, the highest number of successes in any one area being 39 in Lancashire. Passes showed an even better percentage than the previous year when 87 out of 223 candidates were successful.

## Foundation Celebrations

A special sports day at its new recreation ground at Brookfield Works, Widnes, was held on 16 August by J. W. Towers & Co., Ltd., to commemorate the 70th anniversary of the founding of the firm by the late Mr. J. W. Towers in 1882. Parties from Manchester, Liverpool and Stockton-on-Tees branches joined in the programme, which was attended by 400 employees and their families. Prizes for the sports events were presented by Mrs. John S. Towers, wife of the managing director.

## Refinery Explosions at Llandarcy

Explosions caused by gas-cylinders started a fire in the 900-acre grounds of the oil refinery owned by National Oil Refineries, Ltd. (a subsidiary of Anglo-Iranian) at Llandarcy, Neath, on 25 August. Fire engines were sent from Swansea and Glamorgan and the fire was got under control in half an hour. The gas cylinders—about a dozen of them—were in an open air store near the gas-filling station, and pieces of them were scattered over a wide area, injuring several people, and narrowly missing people walking past on the nearby main road, which was subsequently closed by the police for 45 minutes. Only one casualty was severe—a 19-year-old girl whose right leg was badly lacerated. She has been transferred to the plastic surgery hospital at Chepstow, Mon.

## Steelworks in Action

The first section of new steelworks of John Summers & Sons, Shotton, went into action on 19 August. The works are built on nearly 300 acres of reclaimed land on Deeside. Cost of the full development plan is expected to be about £22,000,000—and the output target is 1,000,000 tons of steel a year.

## Disinfectants for Lynmouth

To assist the British Red Cross Relief Undertaking in its campaign to check potential infection as a result of the Lynmouth disaster a gift of disinfectant has been sent by Newton Chambers & Company, chemical manufacturers and engineers, of Sheffield. The consignment of the company's product 'Izal' is sufficient to make 12,000 gallons of disinfectant fluid when diluted.

## Brass Prices Reduced

A decrease in the prices of brass, brass scrap and gilded metal scrap as from 25 August has been announced by the Minister of Supply. Prices of 60/40 brass and brass scrap are reduced by £4 a ton, all other grades of brass and brass scrap by £3 a ton and gilding metal scrap by £1 a ton. The Order, the Copper, Zinc, etc. Prices (No. 5) Order, Statutory Instrument, 1952, No. 1548 has been made to take account of the recent alterations by the Ministry of Materials in its selling price for virgin zinc.

## Nitric Acid Tank Leaks

After nearly ten hours' work, Caernarvon Fire Brigade, on 20 August, finished draining a leaking tanker containing ten tons of nitric acid which was in a siding at Penygroes railway station, Wales. When the firemen arrived, the tanker was enveloped in dense reddish brown fumes of nitrogen tetroxide, and passenger trains on the line were delayed about an hour. Officials from the factory supervised the work and householders in the area were warned by police to take the necessary precautions against the corrosive fumes. Fortunately the wind was blowing away from the houses towards open country. Firemen, at great risk, opened stoppers and vents to allow the acid to drain away while the area in the siding was neutralised.

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## OVERSEAS

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### **Lime Output in the U.S.A.**

Domestic sales of open-market lime in May amounted to 676,457 short tons, compared with 686,369 tons in April, according to reports of producers to the Bureau of Mines, U.S. Department of the Interior. Refractory, chemical and other industrial uses increased slightly over the previous month, but agricultural uses decreased by 31 per cent and there was a slight drop in sales for building applications.

### **Germany Gets Indian Contract**

A contract for installing a coke oven at Sindhri at an estimated cost of Rs.23,500,000 (£1,760,000) is reported to have been awarded by the Sindhri Fertiliser and Chemical Industries to a German firm. The oven is expected to take about 22 months to build and on completion is scheduled to produce 600 tons of coke a day. It is estimated that the installation will result in a saving of Rs.6 (9s.) a ton in the cost of production of fertilisers.

### **Alaskan Smelting Project**

A scheme to construct a \$400,000,000 aluminium smelting project in Alaska as soon as the land can be purchased and Government approval obtained, was announced on 24 August by the Aluminium Company of America. The project is estimated to be initially capable of producing 200,000 tons of aluminium a year. Construction would be in the Taiya valley district, near Skagway. Water, power, subject to the consent of the Government, would be derived from Canadian sources.

### **Brazilian Alkali Industry**

A Joint Brazilian-U.S. Economic Development Commission has approved the proposals of the Cia. Nacional de Alcalis for the installation of a large-scale alkali industry in Brazil. Present plans provide for an initial annual output of 60,000/70,000 tons of caustic soda and 100,000 tons of soda ash and some preliminary work has already been done at the site of the proposed new plant near Cabo Frio, in the State of Rio de Janeiro, where salt and other raw materials are found in abundance.

### **Polish Potash Exports**

Poland is to become an exporter of potassium salts, it is reported, now that a new refinery has just started production at Chelmza. This is the largest of its kind in Poland, and is a sister undertaking of the sugar refinery in the same area.

### **Fertiliser Factory in Norway**

The Norwegian chemical concern, Norsk Hydro, is to build a factory to produce 'complete' fertiliser at the rate of 120,000 tons a year, it is reported. The new plant will be built at Herøya in South Norway, and construction is expected to take about two years.

### **Oil Refinery for Turkey**

Thirty-five thousand tons of petrol per annum, 25,000 tons of kerosene, 37,500 tons of asphalt, diesel oil, etc., will be the output of a new oil refinery which is being built at Batman in Turkey. The contract for the building of the refinery, which will have an estimated capacity of 270,000 tons of crude oil per annum, has been given to an American firm, and it is scheduled to go into operation in two years' time. Development work to increase oil output is in progress at the Ramandag oilfields in south eastern Turkey, as also at Gazan.

### **Value of Israeli Potash**

Potash production in Israel during the first year of operation is expected to reach 60,000 tons, value \$2,500,000, the Israel Minister of Finance announced. This figure is to be increased to 100,000 tons during the second year (value \$4,200,000) and to 135,000 tons (value \$5,700,000) during the third year. It will take another six months of preparatory work before production can get started, and this work is about to begin. It has been announced that the Palestine Potash Company may soon start negotiations with the Jordan government about the fate of its works in that country. It is expected that these negotiations will cover the company's concession, its property in Jordan, and the damages suffered during the Arab-Jewish war of 1948.



## Publications & Announcements

CHEMISTRY and chemical engineering, fuel technology, metallurgy, paints and oils, physics, plastics, and science, are among the 39 subject-classifications covering 5,000 titles of English and American books in the Technical Books List shortly to be published by the Publishers' Circular, Ltd., Beckenham, Kent. The list, price 2s. 6d., is a useful reference work for the individual technician or technical library.

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ANOTHER three-week instruction course for welding engineers, supervisors, inspectors and foremen is announced by The Quasi-Arc Co., Ltd., Bilston, Staffordshire, to begin on 27 October. There will be a series of nine lectures and demonstrations, about half the time being allotted to technical and theoretical work and half to practical welding experience. Applications for enrolment should be sent to Bilston or to Bridgewater House, Cleveland Row, St. James's, London, S.W.1. Local accommodation can be arranged near the Bilston works.

\* \* \*

LATEST issue of the *Indian Journal of Scientific and Industrial Research* to be published is Vol. 11, No. 6, for June, 1952. It contains interesting articles on the colouring effects of iron oxides in glass, the electrolytic production of potassium permanganate, the nature of coal bitumens and other subjects. It also gives an account of the Drug research Laboratory at Jammu-Tawi and of a symposium on the internal combustion engine in India, held at Bangalore on 5-6 April.

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CHEMISTRY'S important rôle in the Colonies where often the young chemist may have to, to some extent, play the part of a missionary in the cause of applied chemistry, is discussed in an article 'The Colonial Chemical Service,' by Dr. W. D. Raymond, F.R.I.C., in the August issue of *The Journal of the Royal Institute of Chemistry* (Vol. 76, Part 4). The article is the first of an interesting series by authorities in their special fields describing some of the various kinds of work in which chemists are engaged, in this country and overseas, together with any special training required and the type of employment offered.

BRITISH abstracts, 'Section "C"—Analysis and Apparatus' (part 8, August, 1952), Nos. 2457-2742, have now been published by the Bureau of Abstracts in conjunction with the Society of Public Analysts and Other Analytical Chemists. This section is issued monthly at a cost of 30s. a year. Other abstract sections and the current annual price to general readers are: A.I-General, physical and inorganic chemistry, 60s.; A.II Organic chemistry, 90s.; A.III Physiology, biochemistry, anatomy, pharmacology, experimental medicine 120s.; B.I. chemical engineering, fuels, metallurgy, applied electrochemistry and industrial inorganic chemistry 70s.; B.II Industrial organic chemistry 80s.; B.III Agriculture, food, and sanitation 50s.

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FREQUENCIES, assignment of quantum numbers and intensities of some 1,800 microwave absorption lines are given in a new publication 'Molecular Microwave Spectra Tables,' by Paul Kisliuk and Charles H. Townes, issued as U.S. National Bureau of Standards Circular 518 (65 cents). Best available values of other pertinent molecular data, such as rotational constants, dipole moments, quadrupole coupling constants, and rotation-vibration interaction constants are included. Only molecular lines of frequency greater than 1,000 megacycles are listed. Applications should be made to the Government Printing Office, Washington 25, D.C. Foreign remittances must be in U.S. exchange and should include an additional one-third of the publication price to cover the cost of postage.

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ALUMINIUM in aircraft—from the first powered flight by the Wright brothers in 1903 using a single hollow aluminium alloy casting for the crankcase and cylinder block, to its application in various forms in the most up-to-date British military and civil aircraft is described in *The Aluminium Courier* (No. 19), published by the Aluminium Development Association. It is pointed out that while the extended use of aluminium in other engineering fields is being aided by knowledge gained in aircraft usage, so conversely, this new experience may ultimately bring benefit to the aeronautical engineer.

# British Chemical Prices

LONDON.—Rather more activity has been reported and with stocks in users' hands at a low level, the improvement is expected to be maintained. Buying for shipment has continued at a steady rate despite keen competition in overseas markets. The movement against contracts in the routine chemicals, such as the potash and soda compounds, has been good with a fair amount of new business, while there has been a moderate demand for arsenic, formaldehyde and hydrogen peroxide.

MANCHESTER.—Little change in the general price situation has occurred during the past week. Most of the leading industrial outlets are calling for fair quantities against contracts and there is a reasonably steady movement of supplies on export account. Fresh business during the week has been on

a moderate scale, with the demand from the textile, bleaching, dyeing and finishing trades a trifle better though still below normal. In the tar products section creosote oil, carbolic acid, and crude tar are going steadily into consumption, as are also the benzoles. The demand for fertilisers is still seasonally quiet, with lower prices for both agricultural nitrate of soda and nitrate of potash.

GLASGOW.—Trade in general chemicals has been rather quiet over the past week with the price tendency being downward. Buyers appear to be waiting until stocks are at a low ebb before giving replacement orders. The textile trade, however, is showing signs of improvement and it is felt that the present phase will soon pass. Although inquiries for export are scarcer, orders placed have been quite worth while.

## General Chemicals

**Acetic Acid.**—Per ton : 80% technical, 1 ton, £110; 80% pure, 1 ton, £116; commercial glacial 1 ton, £130; delivered buyers' premises in returnable barrels; in glass carboys, £7; demijohns, £11 extra.

**Acetic Anhydride.**—Ton lots d/d, £166 per ton.

**Acetone.**—Small lots : 5 gal. drums, £145 per ton; 10 gal. drums, £135 per ton. In 40/50 gal. drums less than 1 ton, £115 per ton; 1 to 9 tons, £114 per ton; 10 to 49 tons, to £113 per ton; 50 tons and over, £112 per ton.

**Alcohol, Industrial Absolute.**—50,000 gal. lots, d/d, 4s. 7½d. per proof gallon; 5000 gal. lots, d/d, 4s. 8½d. per proof gal.

**Alcohol, Diacetone.**—Small lots : 5 gal. drums, £204 per ton; 10 gal. drums, £194 per ton. In 40/45 gal. drums : less than 1 ton, £174 per ton; 1 to 9 tons, £173 per ton; 10 to 50 tons, £172 per ton; 50 to 100 tons, £171 per ton; 100 tons and over, £170 per ton.

**Allyl Alcohol.**—Less than 40 gals., 3s. 10½d. per lb.; 40 gal., 3s. 6½d. per lb.; 2 to 5 40 gal. drums, 3s. 4½d. per lb.; 1 ton and over, 3s. 2½d. per lb.

**Alum.**—Loose lump, £18 per ton, f.o.r. MANCHESTER : Ground, £17 10s.

**Aluminium Sulphate.**—Ex works, £12 per ton d/d. MANCHESTER : £11 10s.

**Ammonia, Anhydrous.**—1s. 9d. to 2s. 3d. per lb.

**Ammonium Bicarbonate.**—2 cwt. non-returnable drums; 1 ton lots £47 per ton.

**Ammonium Chloride.**—Grey galvanising, £31 5s. per ton, in casks, ex wharf. Fine white 98%, £23 12s. 6d. to £26 5s. per ton. See also Sal ammoniac.

**Ammonium Nitrate.**—D/d, £18 to £20 per ton.

**Ammonium Persulphate.**—MANCHESTER : £6 2s. 6d. per cwt. d/d.

**Ammonium Phosphate.**—Mono- and di-, ton lots, d/d, £93 and £91 10s. per ton.

**Antimony Sulphide.**—Golden, d/d in 5 cwt. lots as to grade, etc., 2s. 3½d. to 3s. 1½d. per lb. Crimson, 3s. 4½d. to 4s. 5½d. per lb.

**Arsenic.**—Per ton, £59 5s. nominal, ex store.

**Barium Carbonate.**—Precip., d/d; 2-ton lots, £35 5s. per ton, bag packing.

**Barium Chloride.**—£44 10s. 2 ton lots d/d bags.

**Barium Sulphate (Dry Blanc Fixe).**—Precip., 4-ton lots, £41 per ton d/d; 2-ton lots, £41 5s. per ton d/d.

**Bleaching Powder.**—£21 per ton in casks (1 ton lots).

**Borax.**—Per ton for ton lots, in free 140-lb. bags, carriage paid: Anhydrous, £59 10s.; in 1-cwt. bags; commercial, granular, £39 10s.; crystal, £42; powder, £43; extra fine powder, £44; B.P., granular, £48 10s.; crystal, £51; powder, £52; extra fine powder £53.

**Boric Acid.**—Per ton for ton lots in free 1-cwt. bags, carriage paid: Commercial, granular, £68; crystal, £76; powder, £73 10s.; extra fine powder, £75 10s.; B.P., granular, £81; crystal, £88; powder, £85 10s.; extra fine powder, £87 10s.

**Butyl Acetate BSS.**—£209 per ton, in 10-ton lots.

**Butyl Alcohol BSS.**—£181 per ton, in 10-ton lots. 10 to 49 tons £163 per ton.

**sec. - Butyl Alcohol.**—5 gal. drums £164; 40/45 gal drums: less than 1 ton £144 per ton; 1 to 10 tons £143 per ton; 100 tons and over £140 per ton.

**tert. - Butyl Alcohol.**—5 gal. drums £195 10s. per ton; 40/45 gal. drums: less than 1 ton £175 10s. per ton; 1 to 5 tons £174 10s. per ton; 5 to 10 tons, £173 10s.; 10 tons and over £172 10s.

**Calcium Chloride.**—70/72% solid £9 12s. 6d. per ton, in 4-ton lots.

**Chlorine, Liquid.**—£28 10s. per ton d/d in 16/17-cwt. drums (3-drum lots).

**Chromic Acid.**—2s. 0½d. to 2s. 0¾d. per lb., less 2½% d/d U.K.

**Citric Acid.**—1 cwt. lots, 218s. cwt. 5 cwt. lots, 213s. cwt.

**Cobalt Oxide.**—Black, delivered, 13s. per lb.

**Copper Carbonate.**—MANCHESTER: 2s. 10d. per lb.

**Copper Sulphate.**—£107 17s. 6d. per ton f.o.b., less 2% in 2-cwt. bags.

**Cream of Tartar.**—100%, per cwt., about £11 12s. d/d.

**Ethyl Acetate.**—10 tons and upwards, d/d £174 per ton.

**Formaldehyde.**—£35 10s. per ton in casks, according to quantity, d/d.

**Formic Acid.**—85%, £82 5s. in 4-ton lots, carriage paid.

**Glycerine.**—Chemically pure, double distilled 1,260 s.g. £14 19s. per cwt. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

**Hydrochloric Acid.**—Spot, 12s. to 16s. per carboy d/d, according to purity, strength and locality.

**Hydrofluoric Acid.**—59/60%, about 1s. to 1s. 2d. per lb.

**Hydrogen Peroxide.**—27.5% wt. £124 10s. per ton. 35% wt. £153 per ton d/d. Carboys extra and returnable.

**Iodine.**—Resublimed B.P., 21s. 3d. per lb. in cwt. lots.

**Iodoform.**—25s. 4d. per lb. in cwt. lots.

**Lactic Acid.**—Pale tech., 44 per cent by weight £122 per ton; dark tech., 44 per cent by weight £87 per ton ex works; Usual container terms.

**Lead Acetate.**—White: £162 10s. per ton.

**Lead Nitrate.**—£119 per ton.

**Lead, Red.**—Basis prices per ton: Genuine dry red lead, £154; orange lead, £166 Ground in oil: red, £178 10s., orange, £190 10s.

**Lead, White.**—Basis prices: Dry English, in 5-cwt. casks, £165 per ton. Ground in oil: English, under 2 tons, £184 10s.

**Lime Acetate.**—Brown, ton lots, d/d, £30 to £34 per ton; grey, 80-82%, ton lots, d/d, £34 to £39 per ton.

**Litharge.**—£154 per ton.

**Magnesite.**—Calcined, in bags, ex works, £22 to £24.

**Magnesium Carbonate.**—Light, commercial, d/d, £87 15s.; cwt. lots £97 10s. per ton d/d.

**Magnesium Chloride.**—Solid (ex wharf), £15 per ton.

**Magnesium Oxide.**—Light, commercial, d/d, £221; cwt. lots £227 10s. per ton d/d.

**Magnesium Sulphate.**—£12 to £14 per ton.

**Mercuric Chloride.**—19s. 3d. per lb. in 28 lb. lots; smaller quantities dearer.

**Mercury Sulphide, Red.**—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d. for lots of 7 to under 30 lb.

**Methanol.**—Pure synthetic, d/d, £28 to £38 per ton.

**Methylated Spirit.**—Industrial 66° O.P. 100 gals., 7s. 10d. per gal.; pyridinised 64° O.P. 100 gal., 7s. 11½d. per gal.

**Methyl Ethyl Ketone.**—5 gal. drums, £179 per ton ; in 40-45 gal. drums, less than 1 ton, £159 per ton ; 50 to 100 tons, £156 per ton ; 100 tons and over, £155 per ton.

**Methyl isoButyl Ketone.**—5 gal. drums, £209 per ton ; in 40-45 gal. drums, less than 1 ton, £189 per ton ; 50 to 100 tons, £186 per ton ; 100 tons and over, £185 per ton.

**Nickel Sulphate.**—D/d. buyers U.K. £140 10s. per ton.

**Nitric Acid.**—£35 to £40 per ton, ex works.

**Oxalic Acid.**—About £181 per ton, packed in 5-cwt. lots, packed in free 5-cwt. casks.

**Phosphoric Acid.**—Technical (S.G. 1.500), ton lots, carriage paid, £71 10s. per ton ; B.P. (S.G. 1.750), ton lots, carriage paid, 1s. 3½d. per lb.

**Potash, Caustic.**—Solid, £98 10s. per ton for 1-ton lots ; Liquid, £37 15s.

**Potassium Bichromate.**—Crystals and granular, 11½d. per lb. ; ground, 1s. 0½d. per lb., standard quantities.

**Potassium Carbonate.**—Calced, 98/100%, £116 per ton for 1-ton lots, ex store.

**Potassium Chloride.**—Industrial, 96%, 6-ton lots, £20 to £22 per ton.

**Potassium Iodide.**—B.P., 18s. 7d. per lb. in 28 lb. lots ; 18s. 1d. in cwt. lots.

**Potassium Nitrate.**—Small granular crystals, 81s. per cwt. ex store, according to quantity.

**Potassium Permanganate.**—B.P., 1s. 9½d. per lb. for 1-cwt. lots ; for 3 cwt. and upwards, 1s. 8½d. per lb. ; technical, £9 2s. per cwt. ; for 5 cwt. lots.

**isoPropyl Alcohol.**—Small lots : 5 gal. drums, £156 per ton ; 10 gal. drums, £146 per ton ; in 40-45 gal. drums : less than 1 ton, £126 per ton ; 1 to 9 tons, £125 per ton ; 10 to 50 tons, £124 per ton ; 50 to 100 tons, £123 per ton ; 100 tons and over, £122 per ton.

**Salammoniac.**—Dog-tooth crystals, £72 10s. per ton ; medium, £67 10s. per ton ; fine white crystals, £21 10s. to £22 10s. per ton, in casks.

**Salicylic Acid.**—MANCHESTER : Technical 2s. 6d. to 2s. 7d. per lb. d/d.

**Soda Ash.**—58% ex depôt or d/d, London station, £8 17s. 3d. to £10 14s. 6d. per ton.

**Soda, Caustic.**—Solid 76/77% ; spot, £23 5s. per ton d/d. (4 ton-lots).

**Sodium Acetate.**—£85 to £91 per ton d/d.

**Sodium Bicarbonate.**—Refined, spot, £12 7s. 6d. per ton, in bags.

**Sodium Bichromate.**—Crystals, cake and powder, 9½d. per lb. ; anhydrous, 11½d. per lb., net, d/d U.K. in 7-8 cwt. casks.

**Sodium Bisulphite.**—Powder, 60/62%, £40 per ton d/d in 2-ton lots for home trade.

**Sodium Carbonate Monohydrate.**—£25 per ton d/d in minimum ton lots in 2-cwt. free bags.

**Sodium Chlorate.**—£87 to £95 per ton.

**Sodium Cyanide.**—100% basis, 8d. to 9d. per lb.

**Sodium Fluoride.**—D/d, £4 10s. per cwt.

**Sodium Hyposulphite.**—Pea crystals £28 a ton ; commercial, 1-ton lots, £26 per ton carriage paid.

**Sodium Iodide.**—B.P., 20s. 1d. per lb. in 28 lb. lots.

**Sodium Metaphosphate (Calgon).**—Flaked, loose in metal drums, £123 ton.

**Sodium Metasilicate.**—£22 15s. per ton, d/d U.K. in ton lots.

**Sodium Nitrate.**—Chilean Industrial, 97-98%, 6-ton lots, d/d station, £30 15s. per ton.

**Sodium Nitrite.**—£31 for 1 ton lots.

**Sodium Percarbonate.**—12½% available oxygen, £8 8s. 4½d. per cwt. in 1-cwt. drums.

**Sodium Phosphate.**—Per ton d/d for ton lots : Di-sodium, crystalline, £37 10s., anhydrous, £78 10s. ; tri-sodium, crystalline, £39 10s., anhydrous, £75 10s.

**Sodium Prussiate.**—10d. to 10½d. per lb. ex store.

**Sodium Silicate.**—£6 to £11 per ton.

**Sodium Sulphate (Glauber's Salt).**—£8 per ton d/d.

**Sodium Sulphate (Salt Cake).**—Unground, £6 per ton d/d station in bulk. MANCHESTER : £6 10s. per ton d/d station.

**Sodium Sulphide.**—Solid, 60/62%, spot, £30 per ton, d/d, in drums ; broken, £30 15s. per ton, d/d, in drums.

**Sodium Sulphite.**—Anhydrous, £59 per ton ; pea crystals, £37 12s. 6d. per ton d/d station in kegs ; commercial, £23 7s. 6d. per ton d/d station in bags.

**Sulphur.**—Per ton for 4 tons or more, ground, £22 16s. 6d. to £25 6s. according to fineness.

**Tartaric Acid.**—Per cwt.: 10 cwt. or more, £12 5s.

**Titanium Oxide.**—Comm., ton lots, d/d (56-lb./112 lb. bags), £125 per ton.

**Zinc Oxide.**—Maximum price per ton for 2-ton lots, d/d; white seal, £144 10s.; green seal, £143 10s.; red seal, £142.

#### Rubber Chemicals

**Antimony Sulphide.**—Golden, 2s. 3½d. to 3s. 1½d. per lb. Crimson, 3s. 4½d. to 4s. 5½d. per lb.

**Carbon Bisulphide.**—£65 5s. per ton, according to quality.

**Carbon Black.**—6d. to 8d. per lb., according to packing.

**Carbon Tetrachloride.**—£74 10s. per ton.

**India-rubber Substitutes.**—White, 1s. 9d. to 2s. 2d. per lb.; dark, 1s. 7½d. to 2s. 0½d. per lb.

**Lithopone.**—30%, £60 10s. per ton.

**Mineral Black.**—£7 10s. to £10 per ton.

**Mineral Rubber, 'Rupron.'**—£20 per ton.

**Sulphur Chloride.**—British 48s. 6d. per cwt.; Imported £120 per ton.

**Vegetable Lamp Black.**—£49 per ton

**Vermilion.**—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

#### Nitrogen Fertilisers

**Ammonium Sulphate.**—Per ton in 6-ton lots, d/d farmer's nearest station, £16 18s.

**Compound Fertilisers.**—Per ton in 6 ton lots, d/d farmer's nearest station, I.C.I. Special No. 1 £27 9s.

**'Nitro-Chalk.'**—£12 9s. 6d. per ton in 6-ton lots, d/d farmer's nearest station.

**Sodium Nitrate.**—Chilean agricultural for 6-ton lots d/d nearest station, £28 10s. per ton.

#### Coal-Tar Products

**Benzole.**—Per gal, ex works: 90's, 3s. 8½d.; pure, 3s. 11½d.; nitration grade, 4s. 2½d.

**Carbolic Acid.**—Crystals, 1s. 6d. to 1s. 8d. per lb. Crude, 60's, 8s. MANCHESTER: Crystals, 1s. 6d. to 1s. 8d. per lb., d/d crude, 8s. naked, at works.

**Creosote.**—Home trade, 10d. to 1s. 2d. per gal., according to quality, f.o.r. maker's works. MANCHESTER: 1s. to 1s. 8d. per gal.

**Cresylic Acid.**—Pale 99%, 5s. 8d. per gal.; 99.5/100%, 5s. 10d. American, duty free, for export, 5s. to 5s. 8d. naked at works.

**Naphtha.**—Solvent, 90/160°, 4s. 10½d. per gal. for 1000-gal. lots; heavy, 90/190°, 4s. 3½d. per gal. for 1000-gal. lots, d/d. Drums extra: higher prices for smaller lots.

**Naphthalene.**—Crude, ton lots, in sellers' bags, £18 16s. 3d. to £34 per ton according to m.p.; hot-pressed, £50 to £60 per ton, in bulk ex works; purified crystals, £68 10s. to £79 3s. 4d. per ton.

**Pitch.**—Medium, soft, home trade, 130s. per ton f.o.r. suppliers' works; export trade, 200s. per ton f.o.b. suppliers' port. MANCHESTER: £8 f.o.r.

**Pyridine.**—90/160°, 42s. 6d. per gal. MANCHESTER: 40s. to 42s. 6d. per gal.

**Toluol.**—Pure, 4s. 7½d. per gal. MANCHESTER: Pure, 4s. 7½d. per gal. naked.

**Xylol.**—For 1000-gal. lots, 5s. 6d. per gal., according to grade, d/d.

#### Intermediate and Dyes (Prices Nominal)

*m*-Cresol 98/100%.—3s. 9d. per lb. d/d.

*o*-Creso 30/31° C.—1s. 4d. per lb. d/d.

*p*-Cresol 34/35° C.—3s. 9d. per lb. d/d.

**Dichloraniline.**—2s. 8½d. per lb.

**Dinitrobenzene.**—8½d. per lb.

**Dinitrotoluene.**—48/50° C., 9½d. per lb.; 66/68° C., 1s.

*p*-Nitraniline.—2s. 11d. per lb.

**Nitrobenzene.**—Spot, 5½d. per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyers' works.

**Nitronaphthalene.**—1s. 2d. per lb.; P.G. 1s. 0½d. per lb.

*o*-Toluidine.—1s. per lb., in 8/10-cwt. drums, drums extra.

*p*-Toluidine.—2s. 2d. per lb., in casks.

*m*-Xylidine Acetate.—4s. 5d. per lb., 100%.

## Chemical & Allied Stocks & Shares

THE past month has seen a better trend in stock markets, largely because sentiment has been helped by a renewed rally in British Funds. Buying of gilt-edged stocks, however, has been mainly a 'safety first' policy by investors, who find it difficult to assess the industrial outlook and are inclined to follow a waiting attitude for the time being. It is being assumed that the Commonwealth conference in November may make important decisions designed to rebuild the sterling area's gold and dollar reserves. This implies measures to help export trade; but it is argued that a vital stimulus is needed and that plans may be discussed for making the £ freely convertible. This could revive export trade substantially, and would, it is thought in the City, give a stimulus to invisible exports, such as shipping and insurance services, and so on.

### Confidence in Sterling

If satisfactory plans for making the £ freely convertible could be devised at this stage, it would indicate confidence in sterling and might well have an important psychological influence. The prevailing view is that in the early stages the £ would probably have to be backed by a large dollar loan from Canada, because there might at first be a big demand for sterling for conversion into dollars. Even if full convertibility cannot be achieved at present, it is generally considered that the Commonwealth conference will endeavour to make the £ more widely convertible while at the same time retaining various restrictions to prevent any big loss of dollars.

Chemical and allied shares have reflected the better trend of markets. Imperial Chemicals have improved to 44s. 10½d. at which there is a yield of 5½ per cent on the basis of last year's 13 per cent dividend. Eaglescliffe 5s. shares were 15s. 9d. at which there is a yield of almost 6½ per cent on last year's 20 per cent dividend. Fisons at 29s. 3d. yield 6½ per cent, and Laporte Chemicals 5s. shares at 10s. 7½d. yield 5½ per cent. The decision of the latter company on new capital plans is expected before long.

Hopes of a higher dividend than last year's

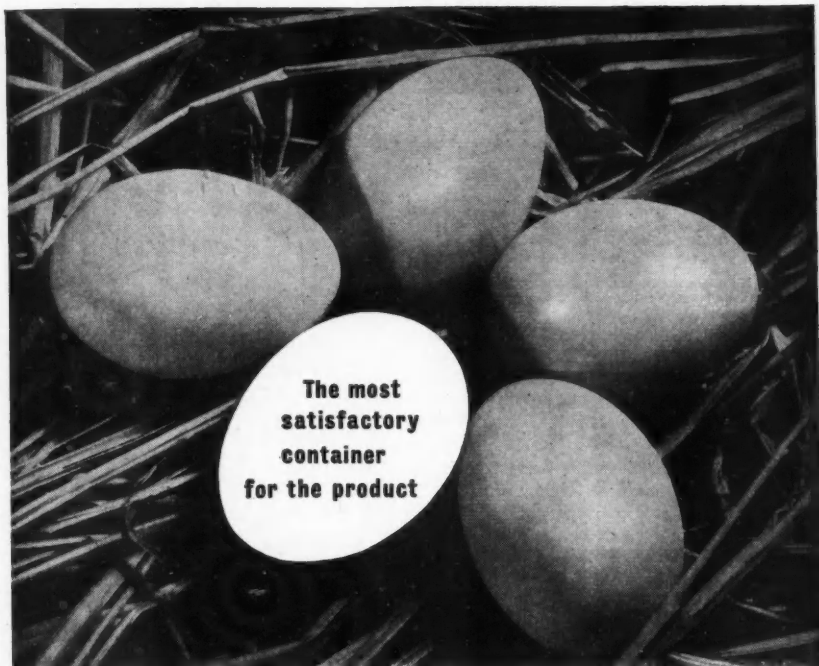
15 per cent are indicated by the yield of 15s. 3d. on the 5s. shares of Albright and Wilson. Elsewhere, Hardman & Holden 5s. shares were 22s. 9d., Boake Roberts 5s. shares 13s. Amber Chemicals again around their par value of 2s., and J. & J. White 12s. Monsanto Chemicals were 26s. 6d. at which the yield on these 5s. shares is less than 4½ per cent, reflecting that shareholders stand to benefit in due course from the company's progressive policy. F. W. Berk 2s. 6d. shares were 6s., Hickson & Welch 9s. 9d., W. J. Bush 47s., Pest Control 5s. shares 4s. 3d., Greiff-Chemical 5s. shares 15s., Brotherton 10s. shares 22s. 9d., Bowman Chemicals 4s. shares 5s. 9d., and Borax Consolidated deferred 36s. 3d. British Glues 4s. ordinary were 10s. and the participating preference £1 shares 27s. 6d. Reichhold Chemicals 5s. shares were 8s. 7½d. compared with the 7s. 7½d. at which dealings started; and the 6½ per cent redeemable cumulative £ preference shares were 20s.

The 4s. units of the Distillers Co. have strengthened to 18s., and United Molasses were 30s. 9d., while Glaxo Laboratories 10s. shares were 75s. 7½d. British Xylonite have been firmed at 24s., with Bakelite 10s. shares 17s. 3d., and British Industrial Plastics 2s. shares 4s. 6d. In other directions, Associated Cement rose to 101s. 9d. Goodlass Wall were 20s. 6d., and paint shares generally firmer. Boots Drug 5s. units were 19s. 1½d., and Sangers 15s. 3d. Oils were generally higher with Shell 85s., Anglo-Iranian £6 1/32, and Burmah Oil active around 46s. 3d. 'ex' the bonus with the new shares at 47s. 3d.

### Dearer Copper in Australia

The price of domestically produced copper in Australia was raised by £A.65 from £A.285 to £A.350 a ton, as from 25 August, it was announced by the Australian Prices Minister. The present price of U.K. copper at £285 a ton is approximately equal to £356 in Australian currency, so that the Commonwealth is now coming into line with the higher price which followed the raising of the U.S. export quotation for the metal in June.



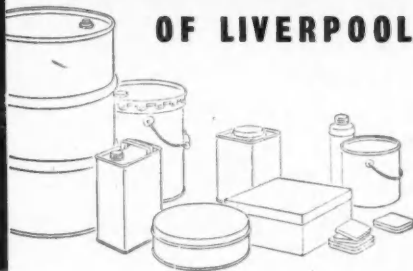


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container  
for the product

Long before the 'chicken versus egg' controversy had hatched itself, nature found a difficult problem on her hands . . . how to protect the delicate interior of an egg from a host of exterior influences. The solution that she found is a classic example of good design — a container perfectly matched to its contents. We, too, have produced many equally satisfactory metal containers in the last 83 years. Half ounce tins to fifty gallon drums are our standard range, as well as other numerous sizes and types of containers in common use. New specifications are also evolved frequently for containers to fulfil special requirements. If you are planning to introduce new lines or to re-introduce old ones in more attractive form, the long experience of Reads of Liverpool is at your service.

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## Law & Company News

The following are taken from the printed reports, but we cannot be responsible for errors that may occur

### Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an \*—followed by the date of the Summary but such total may have been reduced.)

**HUBRON RUBBER CHEMICALS, LTD., Manchester.** (M., 30/8/52). 17 July, debenture, to Mosley Street Nominees, Ltd., securing all moneys due or to become due from the company to Williams Deacon's Bank, Ltd.; general charge. \*£20,000. 21 June, 1951.

**SANITEX PRODUCTS (MANCHESTER), LTD., Swinton,** manufacturing chemists. (M., 30/8/52). 25 July, charge, to Williams Deacon's Bank, Ltd., securing all moneys due or to become due to the bank; charged on leasehold land and buildings at Sutherland Street, Swinton (Lancs.).

### Increases of Capital

The following increases of capital have been announced:—**BOOTS CASH CHEMISTS (EASTERN), LTD.,** from £550,000 to £940,000; **BRITISH OXYGEN CO., LTD.,** from £10,000,000 to £15,000,000; **STAFFORD ALLEN & SONS, LTD.,** from £150,000 to £500,000; **FORTH CHEMICALS, LTD.,** from £90 to £1,000,000. (British Petroleum Chemicals were allotted 659,940 'A' shares, and Monsanto Chemicals, Ltd., 329,970 'B' shares); **F. HIRSCH & CO., LTD.,** from £1,000 to £2,000; **TREFOREST CHEMICAL CO., LTD.,** from £100,000 to £150,000.

## New Registrations

### Agricultural Sprayers and Contractors (Yorkshire), Ltd.

Private company. (510,635). Capital £10,000. Manufacturers of chemicals, fertilisers, manures, fibres, fumigants, etc. Directors: E. Hardy, J. Hardy. Reg. office: West End Works, Bruntcliffe, Morley, Yorks.

### Aden Petroleum Refinery, Ltd.

Private company. (510,676). Capital £100. To erect, own and operate refineries for the refining and treatment of mineral and other oils and any derivatives therefrom, as well as their admixture or blending with other substances, etc. Directors to be appointed. Reg. Office: Britannic House, Finsbury Circus, London, E.C.2.

### Fuel Oil Research Company, Ltd.

Private company. (510,682). Capital £100. To carry on research into matters affecting fuel, oil, oil handling, consumption and efficiency, combustion, refractories, refractory performances, etc. Directors to be appointed. Solicitors: Slaughter & May, 18 Austin Friars, London, E.C.2.

## Company News

### A. Boake Roberts and Co., Ltd.

An increase in turnover of £1,000,000 is reported in the statement of Mr. E. J. Boake, chairman of A. Boake, Roberts & Co., Ltd., for the year ended 31 March, 1952. Home sales increased by 28 per cent and exports by 25 per cent. Despite the tendency for trade to slacken off in the chemical industry and impact of EPL, there seems a reasonable prospect of the 17½ per cent distribution for the past year being maintained.

### Borax Consolidated, Ltd.

An interim dividend of 2 per cent (less tax) on deferred ordinary stock has been declared by Borax Consolidated, Ltd., for the year ended 30 September, 1952. Coupon No. 66 on the deferred ordinary warrants to bearer will be paid on and after 23 Sept.

### International Bitumen Emulsions, Ltd.

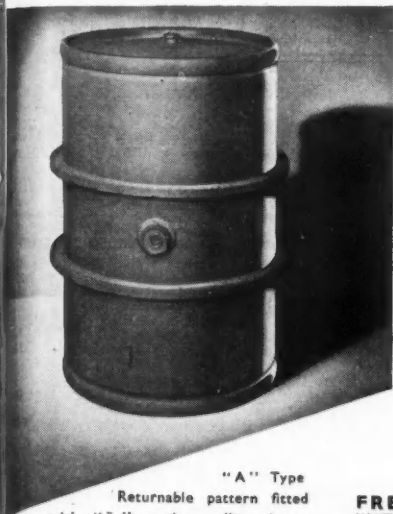
The 24th annual general meeting of International Bitumen Emulsions, Ltd., was held in London on 25 August. Mr. J. A. Montgomerie, the chairman, presided. Profits of the group, before taxation, amounted to £122,668 which was more than double last year's comparable figure of £58,171. Ordinary dividend for the year ended 31 March, 1952, was increased from 7½ per cent, which last year absorbed £8,849, to 12½ per cent, which for the period under review on the greatly increased capital of the company, absorbs £25,865.

"BRABY" Regd.

# Steel Drums

Our Liverpool Factory is equipped with modern plant for the production of Steel Drums of many types, single tripper and returnable.

These can be supplied with the exteriors painted and several types may be galvanized, tin or lacquer lined. Certain Drums can be decorated in colours and thus provide users with the opportunity of having the ends of the Drums printed with their name and trade mark.



"A" Type

Returnable pattern fitted with "I" section rolling hoops and half oval end copes, all seams welded.

"D" Type.  
Body seam  
welded, ends  
double seamed  
to body.



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# CLASSIFIED ADVERTISEMENTS

## EDUCATIONAL

### UNIVERSITY OF MANCHESTER

The next session commences on Thursday.  
2nd October, 1952.

## SITUATIONS VACANT

*The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive, or a woman aged 18-59 inclusive, unless he or she, or the employment, is exempted from the provisions of the Notifications of Vacancies Order, 1952.*

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**CHEMIST.** The Midland Tar Distillers, Ltd., Oldbury, near Birmingham, have a vacancy in their Research Department for a chemist, aged 23/35 years, with Degree or A.R.I.C. and preferably some industrial experience, for technical service and development work on coal tar products. Experience in organic or inorganic analysis or in the treatment of effluents would be an asset. Please reply to Personnel Manager.

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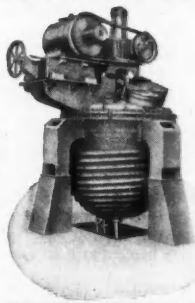
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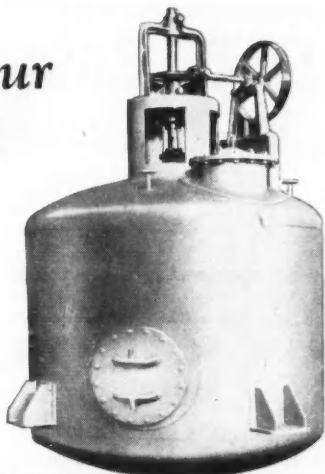
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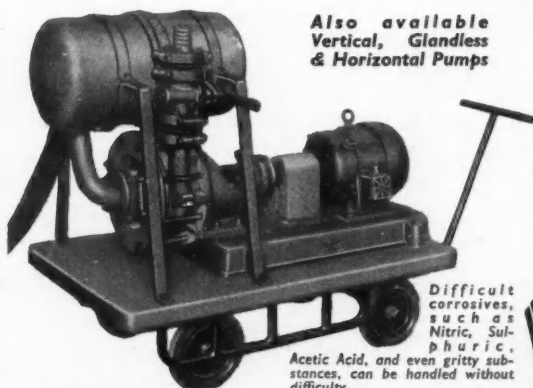
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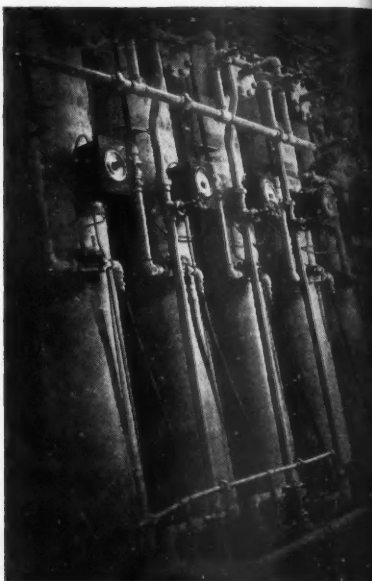
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